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Site: <u>Chevron Chemical</u>
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Other: <u>OKP</u>
<u>9-15-88</u>

AMENDMENTS TO THE JUNE 26, 1987 WORK PLAN
FOR THE
ORTHO-CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI

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September 15, 1988

WCC Project 13C114-19

30825514



Superfund

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1.0 INTRODUCTION

At the request of the U.S. Environmental Protection Agency (USEPA), Chevron Chemical Company and its consultant, Woodward-Clyde Consultants (WCC) submitted a Work Plan to USEPA to address and guide proposed field and office studies concerning Chevron's Maryland Heights, Missouri facility. The Work Plan, dated June 26, 1987, provided for an investigation to characterize the site followed by various assessments to select appropriate and cost effective remedial responses.

The proposed field studies described in the Work Plan were completed in 1987 and the new data were summarized in a revised Site Characterization Report (SCR) dated February 10, 1988. At Chevron's request, the SCR was discussed in conference on June 7, 1988 with representatives from USEPA and their subcontractor, Tetratex, Chevron Chemical Company, and WCC. During the meeting, WCC presented an overview of the data generated during the July 1987 investigation and observed trends in ground water quality at the site. Changes to the scope of work and schedule described in the Work Plan were also discussed. It was agreed that USEPA would formally approve the Work Plan and review and comment on any proposed changes and/or amendments to the Work Plan prior to Chevron's proceeding with further work.

In a letter to Chevron Chemical Company dated June 24, 1988 USEPA provided Chevron with a list of comments to be addressed in the amendments to the Work Plan. The USEPA also requested that a Risk Assessment and Response Action Plan be prepared for the site. Chevron responded in a letter dated July 21, 1988 by providing a list of action items and schedule for future studies.

Based on the recent discussions between USEPA and Chevron, changes to the existing Work Plan are required to update the Work Plan and incorporate the items requested by USEPA. The purpose of this document is to update the

Work Plan and provide information necessary to guide the proposed additional field and office studies concerning the Maryland Heights, Missouri facility.

The amendments presented in this document are intended to supplement the existing Work Plan. The provisions of the Work Plan dated June 26, 1987 remain in effect except as amended or clarified below. It is assumed that the reader is familiar with the Work Plan dated June 26, 1987 and the SCR dated February 10, 1988.

The future studies at the site will be directed towards implementation of long-term remedial responses. Certain remedial responses will be implemented following approval of the Work Plan amendments. These responses will include:

- o design/construction of a storm sewer to manage surface water run-on within the western portion of the site;
- o design/construction of a low permeability surface cap for unpaved areas of the site. The cap will be designed to reduce surface water infiltration and eliminate the potential for wind blown contamination.
- o replacement of the existing storm water retention pond. This facility will be replaced by a larger containment basin for temporary storage of storm water and fire water. The new facility will be designed with a low permeability liner to reduce seepage losses from the basin.

Additional long-term remedial responses may be required to address ground water concerns and public health issues related to off-site contamination of surface soils. To better address these issues, a supplemental field investigation is planned to better define the horizontal and vertical extent of off-site contamination in soil and ground water (if any). The field investigation will also include ambient air sampling to evaluate potential airborne contaminants. The data contained in the revised SCR dated February 10, 1988 and additional information obtained from the supplemental field investigation described in this document will be used to

prepare a baseline public health evaluation (endangerment assessment) for the site. The EA will focus on public health concerns related to off-site contamination of soil and ground water. Ultimately, the findings of the EA will be used to prepare a Response Action Plan (RAP) for the site.

In summary, the major tasks addressed by this Work Plan amendment include:

- o supplemental field investigation;
 - off-site soil sampling
 - on-site soil sampling
 - monitoring well installation
- o continuation of quarterly ground water monitoring;
- o preparation of an endangerment assessment;
- o identify/design interim responses for off-site contamination;
- o implement interim responses;
- o preparation of a response action plan; and
- o design/construction of selected long-term remedial responses
 - surface water run-on controls
 - surface water infiltration controls
 - containment basin replacement;
- o design/implement selected responses for ground water and off-site soil contamination.

The major tasks are listed in Figure 1 with the estimated schedule for implementation of the tasks. The schedule presented in Figure 1 replaces Figure 10 in the original Work Plan and supercedes the schedule discussed in USEPA's letter dated June 24, 1988 and the July 21, 1988 Chevron letter to USEPA.

2.0 SITE DESCRIPTION AND BACKGROUND

The reader is referred to the revised SCK dated February 10, 1988 for a detailed summary of the site and investigations conducted through 1987.

3.0 PROPOSED FIELD INVESTIGATION

A supplemental field investigation is proposed to further refine the site characterization and to provide data necessary for the endangerment assessment (EA). The field investigation will include on-site and off-site activities as described below.

3.1 ON-SITE ACTIVITIES

The supplemental field investigation will consist of three primary tasks:

- o quarterly ground water monitoring;
- o additional soil sampling within the western portion of the site to include the present containment basin and the north/south drainage ditch; and
- o air sampling.

3.1.1 GROUND WATER SAMPLING

3.1.1.1 Objectives and Scope

Quarterly ground water sampling will continue as described in the original Work Plan. Additionally, the two wells installed off-site in 1987 (OWC-24 and OWC-25) and the two proposed off-site bedrock wells (OWC-26 and OWC-27) will be included in the quarterly ground water sampling program. Quarterly ground water sampling will continue until the effectiveness of the selected remedial responses are assessed.

Ground water samples will be analyzed for the parameters listed in Table 1. In addition, OWC-26 and OWC-27 will be analyzed initially and during confirmatory sampling for chlordane, heptachlor, endrin, methoxychlor, and toxaphene. Historically, these compounds were a part of the quarterly ground water sampling list of analytes. They are being deleted at this time because chlordane, endrin, methoxychlor, and toxaphene have not been detected above their respective detection limits over the past 16 sampling

events and heptachlor has not been detected above its detection limit over the past 9 sampling events. If the new off-site wells also exhibit non-detectable levels of these compounds during initial and confirmatory sampling, they will be dropped from further evaluation in these wells also.

3.1.2 SHALLOW SOIL SAMPLING

3.1.2.1 Objective and Scope

Additional soil sampling is proposed within the western portion of the site to further refine the site characterization. It is anticipated that seven borings will be completed on the western portion of the site using a combination of hand augering and mechanical drilling techniques. The 1988 soil sampling program will include sampling of the drainage ditch (four borings) that runs north-south through the western portion of the site and the storm water retention basin (three borings) in the northwestern portion of the site.

Drainage Ditch: Four soil borings are planned along the alignment of the drainage ditch that runs north-south in the western portion of the site. The proposed boring locations are shown on Figure 2. The borings will be advanced using a stainless steel bucket auger to a depth of approximately 3 feet. Auger cuttings from each 18-inch interval will be composited. Each composite sample from 0 to 1.5 feet will be submitted for chemical analysis for the parameters listed in Table 2. The composite samples from 1.5 to 3 feet will be archived at the facility in a restricted access freezer at or below 4°C. Selected archived samples may be analyzed following review of the initial analytical results (refer to Section 4.1 for additional discussions concerning the testing of archived samples).

Containment Basin: Three soil borings are planned within the floor of the existing containment basin. Boring locations will be selected in the field with the aid of a random number table. Dimensions of the basin will be

measured in the X and Y direction using the southwestern corner of the basin as the point of origin. The dimensions will then be multiplied by the respective random numbers and the borings field located.

The three borings will be advanced using a stainless steel bucket auger to a depth of approximately 3 feet. Auger cuttings will be composited from 0 to 1.5 feet and 1.5 to 3 feet. Equal portions of each discrete sample from 0 to 1.5 feet will be composited into one sample for chemical analysis. The same approach will be used to generate a composite sample from 1.5 to 3 feet for chemical analysis. Samples will be analyzed for the parameters listed in Table 2. The discrete samples from each boring will be archived at the facility in a restricted access freezer at or below 4°C. Selected archived samples may be analyzed following review of the initial analytical results.

Western Portion of Site: All unpaved areas in the western portion of the site will receive a low permeability surface cap as part of the planned long-term remedial responses (refer to Section 7.0). The approximate area to be capped is shown in Figure 3. Except as noted above, no additional soil sampling within the western portion of the site is planned at this time.

Soil Stockpile Area: Sampling of the soil stockpile located west of building 'D' was conducted in 1987 and revealed varying concentrations of the pesticides of concern and arsenic. No additional sampling of the stockpile area is planned at this time. The stockpile area is the site of a proposed new containment basin that is currently under design (refer to Figure 3). Construction of the basin is expected to require excavation and disposal (at a regulated landfill) of portions of the stockpile and underlying soil. A sampling plan will be part of the design documents for the new basin. The sampling plan will provide for documentation of the contaminant concentrations of the materials left in place. Any contaminated areas of the stockpile not removed during construction of the new containment basin will receive a surface cap.

3.1.2.2 Technical Approach

Procedures for soil sampling along with associated documentation and decontamination procedures will be consistent with the Sampling Plan and QA/QC Plan included as Appendices 3 and 4 of the original Work Plan. Mechanical drilling equipment will be utilized where access with a drilling rig is attainable. In areas where a drilling rig cannot be mobilized hand augering techniques will be employed.

In addition to Wilson Laboratories of Salina, Kansas, a second analytical laboratory, metaTRACE, Inc. of Earth City, Missouri, is proposed as an alternate laboratory for future activities. The final selection of the analytical laboratory will be made prior to the start of field activities and will be based on the laboratory's current loading and ability to process the samples in a timely manner. A copy of metaTRACE's quality assurance plan is provided as Attachment 1.

3.1.3 AMBIENT AIR SAMPLING

Ambient air sampling was not included in the scope of work described in the Work Plan dated June 26, 1987. However, USEPA has expressed concern about potential health risks associated with exposure to airborne dust that may include the pesticides of concern and arsenic. To address these concerns and provide data for the endangerment assessment, an ambient air sampling program is planned as part of the supplemental field activities.

The ambient air samples will be collected in the fall months of 1988 using high-volume sampling techniques. Two sampling events are planned. The sampling events will be spaced as weather permits to reflect prevailing wind directions. Each of the sampling events will include one upwind and three downwind sampling stations. Sample stations will be selected based on the anticipated prevailing wind patterns and site conditions. All sample locations will be established near the perimeter of the facility in a portion of the site dictated by short-term weather forecasts. A wind

rose for Lambert Air Field, presented as Figure 4, will be used to establish prevailing wind directions. Short-term local forecasts will be utilized to select the final sampling locations within 24 hours of the scheduled sampling event. There is no criteria on wind direction or the minimum wind velocity for a sample to be acceptable.

Attempts will be made to collect all air samples during periods with no precipitation. If one-quarter inch or less of rain falls in the first 15 hours of the 24-hour sampling event, the air samples will be considered acceptable.

The ambient air sample stations will use high-volume samplers powered by electricity from an outlet or generator. The samplers will be equipped with the necessary hardware to collect total particulates and potential pesticide vapors associated with the particulate fraction. Total particulates will consist of ambient air particulates larger than 0.3 microns. The particulate fractions will be collected on a quartz fiber filter while the vapor fractions will be absorbed to a polyurethane foam (PUF) cartridge. Samples collected will be analyzed for the parameters listed in Table 3.

In addition, one sample station will be paired with a General Metal Works PM-10 type sampler or its equivalent. This sampler will collect particulates from 0.3 microns to approximately 10 microns. The information will be used to evaluate the respirable particulate fraction for input into the endangerment assessments.

A meteorological station will be established during the collection events to monitor wind direction and wind speed. The weather station at Lambert Air Field will be used to document barometric pressure, temperature, and rainfall.

The following outlines the general procedures that will be used to collect ambient air samples. All samples will be collected in accordance with EPA method T04 (see Attachment 2).

- A. Set-up the high-volume samplers at the designated locations in an unobstructed area at least 2 meters from any obstacle to air flow. If a generator is used, place the generator a minimum of 24 feet downwind of the samplers.
- B. Conduct a calibration check on the sampler according to established manufacturer instructions.
- C. Place a clean sampling module with a quartz fiber filter and PUF cartridge into the sampler using forceps and latex gloves.
- D. Check the zero reading on the Magnehelic gauge. Record the ambient temperature, barometric pressure, elapsed time meter setting, sampler serial number, filter number, and glass fiber filter lot number in the field logbook.
- E. Turn on the power switch, activate the elapsed time meter, and record the start time. Adjust the flow rate, if necessary, using the flow control valve.
- F. Check and record the flow rate every 6 hours. Record the ambient temperature and barometric pressure concurrently.
- G. At the end of the sampling period, turn off the power and record the end time. Remove the particulate filter and PUF cartridge and wrap them in aluminum foil. Place the samples in sealed, inert, labeled containers for transport to laboratory at 20°C.
- H. Complete the sample collection field sheet and chain-of-custody forms.

3.2 OFF-SITE ACTIVITIES

The supplemental field investigation will include additional shallow soil sampling in the locations proposed on Figure 2. In addition, off-site field activities will include the installation of two additional ground water monitoring wells, initial and confirmation sampling of these wells, and sampling these wells at times corresponding with the quarterly ground water sampling.

It is noted that installation of the off-site wells and off-site soil sampling requires access to adjoining properties. If property access should become a problem and substantially delay scheduled field activities, USEPA will be notified immediately and a revised schedule will be discussed.

3.2.1 OFF-SITE WELL SURVEY

This task, described in Section 3.2.1 of the original Work Plan, will be initiated only if contaminant levels in the existing or proposed off-site monitoring wells exceed their respective MCLs or other health advisory criteria. If contaminants are detected in the off-site monitoring wells for two consecutive quarters at concentrations exceeding their MCLs or health advisory criteria, an off-site well survey to supplement the work conducted by WCC in 1981 and 1984 will be conducted. (Note: A survey of existing wells within 3 miles of the site was conducted in 1981 and 1984. Refer to the revised SCR dated February 10, 1988 for detailed information). The survey will consist of field identification of downgradient wells of record on file at the Missouri Department of Natural Resources, Division of Geology and Land Survey at Rolla, Missouri. Downgradient wells will be those defined by the potentiometric surface based on water levels from the on-site and off-site ground water monitoring wells. Any wells that are field located will be checked where possible for water level, total depth, and casing size if possible. All off-site wells will be evaluated for their potential use in the characterization of potential off-site contaminant migration.

3.2.2 DRILLING AND WELL INSTALLATION

3.2.2.2 Locations

The approximate locations of the two off-site well locations are shown in Figure 5. The two wells, identified as OWC-26 and OWC-27, will be screened in the upper limestone.

3.2.2.3 Technical Approach

Drilling procedures, sampling procedures, documentation, and decontamination for the two proposed off-site wells will be consistent with those described in Section 3.2.2 of the original Work Plan and the Sampling Plan.

Slug tests will be conducted in OWC-24, OWC-25, OWC-26, and OWC-27 as part of the supplemental field investigation to evaluate the effectiveness of the wells and to aid in hydrologic characterization of the site.

3.2.3 GROUND WATER SAMPLING

OWC-26 and OWC-27 will be sampled within one week after completion of installation and development. A verification sampling and analysis event will be performed approximately two (2) weeks after the initial sampling of these wells. The proposed off-site wells will then be included in the quarterly ground water monitoring network. Parameters for ground water analysis are listed in Table 1.

3.2.4 SHALLOW SOIL SAMPLING

The 1987 soil sampling in the vicinity of the arsenic off-loading area (refer to Figure 2) showed arsenic and pesticide contamination in the soil samples obtained. To better define the horizontal and vertical distribution of contaminants in this area, it is anticipated that the supplemental field investigation will include 19 soil borings within the unpaved area immediately north of the site property. The proposed boring locations are shown in Figure 2. Additionally, five borings are planned along the alignment of a drainage ditch that flows from west to east along the north property line. These proposed borings are shown in Figure 2 but may be relocated in the field. Any decision to relocate these borings will be based on communications between the WCC field manager and Chevron Chemical Company.

The off-site borings will be drilled with a truck-mounted drill rig where access permission can be obtained and the boring locations are accessible to the equipment. Drilling and sampling procedures will be consistent with the previous borings in this area, except the sample intervals will be 0 to 0.5 feet, 0.5 to 2 feet, 2 to 4 feet, and 4 to 6 feet. Where truck access is not feasible, the borings will be advanced using hand augering techniques. Auger cuttings will be collected from the depth intervals described above for chemical analysis.

Samples from the 0 to 0.5 feet and the 0.5 to 2 feet depth intervals will be submitted for chemical analysis of the parameters listed in Table 3. The remaining samples will be archived at the facility in a restricted access freezer at or below 4°C. Following review of the initial analytical results, selected archived samples may be submitted for chemical analysis.

4.0 DATA MANAGEMENT

4.1 LABORATORY TESTING

Both Wilson Laboratories of Salina, Kansas and metaTRACE of Earth City, Missouri are being considered for future analytical services. The USEPA will be advised in writing of the laboratory selected for this project prior to start of field work.

All analyses will be performed in accordance with standard USEPA methods as detailed in the approved Quality Assurance/Quality Control (QA/QC) Plan (Appendix 4 to the June 26, 1987 Work Plan).

As part of the laboratory program, at least five of the initial soil samples analyzed during the field investigation will be returned from the laboratory to the field archive. These samples will serve as control samples. It is intended that these five samples will have a range of contaminant concentrations. At such time when any archived samples are submitted to the laboratory for analyses, the previously analyzed control samples will be returned to the laboratory and re-analyzed. Comparisons

will be made between the two sets of analytical results from the control samples to determine the percent degradation, if any, and, thus, provide confirmation of the validity of the archived samples. In order that sufficient sample volume remains to return the material to field archives, approximately two times the necessary sample volume will be collected at five randomly selected locations.

5.0 INTERIM POTENTIAL MITIGATION MEASURES

The Work Plan dated June 26, 198⁷~~8~~ provides for an assessment of interim potential mitigation measures including targeted removals, surface water infiltration controls and ground water pumping and treatment. As shown on Figure 1, the revised Work Plan schedule also includes implementation of certain long-term remedial responses (refer to Section 7.0). During the endangerment assessment, a review of interim responses will be made to evaluate whether short-term measures are necessary to reduce the potential for human exposure and environmental migration of contaminants via direct contact with soil, airborne dust, and surface water in the off-site area north of the site. A report containing proposed interim responses for the off-site area adjacent to the facility is expected to be submitted to USEPA for review approximately two months after completion of the supplemental field investigation.

6.0 ENDANGERMENT ASSESSMENT

Task 9 of the project schedule shown in Figure 1 provides for an endangerment assessment (EA) of the site based on existing data and data obtained from the supplemental field investigation. The EA is expected to be submitted to USEPA for review approximately four months after completion of the supplemental site investigation. The findings of the EA will be utilized in developing the response action plan (RAP) for the facility. The focus of the EA and RAP will be ground water and off-site soil contamination. The following amendments replace Section 6.0 of the original Work Plan.

The "endangerment assessment" (baseline public health evaluation) will be conducted in accordance with the Superfund Public Health Evaluation Manual (USEPA 504/1-86/060, October 1986) and other relevant guidance documents. The evaluation is a sequential procedure wherein an estimate can be made that a threatened or actual release of a potentially hazardous substance does or does not pose danger to public health, welfare, or the environment.

The EA evaluates the collective demographic and geographic data of the site integrated with physico-chemical data, chemical exposure information, and biological effects of the substances of concern to estimate the significance of risks.

The ultimate goal of this EA is to assess any potential risks posed by the substances of concern and ultimately to provide guidelines for establishing cleanup criteria for contaminated soil and ground water if any cleanup is required.

The EA process which will be followed utilizes the following five components:

- o Indicator Chemical Identification;
- o Exposure Assessment;
- o Toxicity Assessment;
- o Risk Characterization; and
- o Uncertainty Analysis.

6.1 INDICATOR CHEMICAL IDENTIFICATION

The indicator chemicals for the Chevron facility in Maryland Heights, Missouri have already been identified. These compounds are chlordane, heptachlor, aldrin, dieldrin, lindane, 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, and arsenic. Factors influencing the fate and potential transport of these compounds such as water solubility, organic partition coefficient, Henry's constant, and vapor pressure will be identified and discussed.

6.2 EXPOSURE ASSESSMENT

This component identifies the actual or potential routes of exposure. This step also involves characterizing the exposed populations and estimating the actual or potential extent of exposure. The exposure assessment process will consist of the following basic steps.

6.2.1 IDENTIFICATION OF EXPOSURE PATHWAYS AND EXPOSED POPULATIONS

In this step, possible release sources, media, and human exposure points are identified. In addition, population subgroups, which may represent special risk groups, are identified.

6.2.2 QUANTIFICATION OF CHEMICAL RELEASE

This step evaluates and calculates release rates from various media such as air and soil as they relate specifically at the study area.

6.2.3 EVALUATION OF ENVIRONMENTAL FATE

The behavior of the substances of concern in the environment will be evaluated in this step. This information will be evaluated relevant to its impact on human exposure.

6.2.4 ESTIMATION OF CHEMICAL INTAKE

Based on sampling data information, estimates will be calculated for contaminant intake by various routes of exposure such as oral ingestion, inhalation, and skin absorption. These estimates will utilize factors which take into account bioavailability data which will allow scientific calculation of bio-uptake of the compounds. Published reports on bio-uptake of chemicals will be reviewed to obtain this information.

6.2.5 COMPARISON TO REQUIREMENTS, STANDARDS, AND CRITERIA

An evaluation of cleanup criteria will be made with respect to the compounds of concern, the exposure pathway, and applicable and relevant and appropriate standards.

6.3 TOXICITY ASSESSMENT

This component involves an evaluation of the nature and extent of health hazards associated with exposure to the substances of concern. The objectives of this assessment are to present critical toxicity values for non-carcinogenic (acceptable intakes for subchronic and chronic exposure) and carcinogenic effects (potency factors). A general discussion of acute, chronic, reproductive, genotoxic, and other effects will also be developed to allow for a more complete evaluation of potential health effects.

6.4 RISK CHARACTERIZATION

This is the step in the baseline endangerment assessment process in which comparisons are made between projected intakes and reference levels for non-carcinogens (i.e. allowable daily intakes) and between calculated risks and target risks for potential carcinogens.

A hazard index for non-carcinogenic effects will be calculated according to the equation given below:

$$\text{Hazard Index} = E/RL + E_2/RL_2 + \dots E_i/RL_i$$

where E_i = Exposure level (or intake) for the i^{th} toxicant

RL_i = Reference level (or intake) for the i^{th} toxicant.

This assumes that multiple subthreshold exposures could result in an adverse effect and that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to acceptable exposures.

Potential carcinogenic risks will be calculated using the following equations:

$$\text{Carcinogenic Risk} = [\text{CDI (route of exposure)} \times \text{Carcinogen Potency Factor (route of exposure)}]$$

(Where potency factors are known.)

These values then represent the risks or hazards presented by the site as a "baseline" evaluation.

6.5 UNCERTAINTY ANALYSIS

As with many processes in the scientific area, risk assessments are based on best estimates. There are a number of uncertainties inherent in this process. Therefore, an uncertainty analysis will be conducted in accordance with the guidance document to minimize the effect of any biases which may have been incidentally introduced into the effect of extrapolation of toxicity data from animals to humans, extrapolation of toxicity data from high dose to low does, and completeness of site characterization.

7.0 EVALUATION AND NEED FOR IMPLEMENTATION OF POTENTIAL REMEDIAL RESPONSES

The provisions of Section 7.0 of the June 26, 1987 Work Plan remain appropriate excluding Section 7.4. Section 7.4 describes an Alternate Concentration Limit (ACL) demonstration which was initially considered as an approach to arrive at acceptable levels for clean up at the site. However, the new CERCLA ACL policy includes major restrictions on how USEPA can utilize the health-protective ACLs. Consequently, the ACL demonstration included in Section 7.4 is deleted from further consideration.

Chevron plans to proceed with implementation of certain long-term remedial responses following USEPA approval of the Work Plan amendments. These responses are described below:

Surface Water Run-on Controls: At present, an open ditch oriented north/south carries surface water run-on across the western portion of the site. The open ditch discharges into a 30-inch culvert located west of the existing containment basin. The culvert flows underground to the north on the property north of the Chevron facility. To reduce surface water infiltration across the site and possible migration of contaminants, the open ditch will be replaced with a subsurface storm sewer. The new storm sewer will be located near the alignment of the existing ditch and designed to discharge into the existing sewer, refer to Figure 3. The depth of excavation required to establish the design flow line is expected to be nominal. Any excavated materials will be used as backfill or disposed of off-site as hazardous waste. Design studies for the sewer will include a topographic survey of the sewer alignment and preparation of plans and specifications. As shown in Figure 1, construction of the sewer is scheduled for 1989.

Surface Water Infiltration Controls: The majority of the site is covered by buildings or pavements except for the western portion of the site. To further reduce surface water infiltration in the western portion of the site, this area will be capped with low permeability materials such as clay, reinforced concrete, asphaltic concrete, or a combination thereof. The approximate area to be capped is shown on Figure 3. Design studies for the surface cap will include a topographic survey and preparation of design plans and specifications. As shown in Figure 1, construction of the surface cap is scheduled for 1989.

Containment Basin: The existing containment basin will be replaced with a larger basin designed to minimize seepage losses from the basin (refer to Figure 3). The basin will be used for temporary storage of surface water runoff and fire water in the event of an on-site fire. All excavated materials will be disposed of as hazardous waste.

It is anticipated that the initial construction activities described above will consist of sewer construction followed by surface capping the western portion of the site excluding the new containment basin. The new basin

will be constructed prior to decommissioning of the existing basin. In the latter stages of the site improvements, the area of the old basin and any unpaved areas surrounding the new basin will be capped.

The evaluation and need for implementation of additional remedial response will be based on the findings of the endangerment assessment. Certain interim responses for the off-site areas of soil contamination (i.e. access restrictions, placement of a geosynthetic cover to reduce wind blown contamination) will be reviewed and implemented, if necessary, when the results of the EA are available. The evaluation of long-term remedial responses for ground water and off-site soil contamination will be summarized in a Draft Response Action Plan to be submitted to USEPA for review approximately eight months (refer to Figure 1) after completion of the supplemental field investigation.

8.0 SCHEDULE

The schedule presented in Figure 10 of the original Work Plan is replaced by Figure 1 in this document.

Appendix 1 - Data Not Previously Reported

There are no amendments to this appendix of the original Work Plan.

Appendix 2 - Health and Safety Plan

The Health and Safety Plan has been reviewed based on the new data obtained in 1987. The original plan provided for all field work to be accomplished in personnel protective equipment equivalent to USEPA Modified Level D protection, except for intrusive activities in Area 1, a suspected Maneb burial area. Work in this area was to be accomplished in personnel protective equipment equivalent to USEPA Level C protection. Based on the 1987 sampling data, all future sampling activities at the site will be accomplished in personnel protective equipment corresponding to USEPA Modified Level D. The new data has been reviewed in response to USEPA's concern that airborne contaminants, particularly arsenic, may pose a threat to field personnel. No upgrade in respiratory protection is required based on the present data.

Appendix 3 - Sampling Plan

The scope of work for the supplemental field investigation is described in previous sections of this document. The basic provisions of the sampling plan except as amended by this document remain in effect for future drilling and sampling activities at the site. Future work will also be consistent with clarifications to the sampling plan provided in Chevron's letter to USEPA dated February 8, 1988. A copy of that letter is provided in Attachment 3 for reference.

Appendix 4 - QA/QC Plan

The provisions of the QA/QC plan presented in the June 26, 1987 Work Plan remain in effect except as amended by this document. In particular, the parameters for ground water and soil sample analyses are amended by Tables 1 through 4 in this document. Additionally, a second analytical laboratory, metaTRACE, Inc., is under consideration for future studies. A copy of the QA plan for metaTRACE, Inc. is presented in Attachment 1 of this document.

TABLE 1
PARAMETERS FOR CHEMICAL ANALYSIS OF
GROUND WATER SAMPLES

<u>Pesticides (Herbicides)</u>	<u>Pesticides (Insecticides)</u>	<u>Volatile Organics</u>	<u>Metals</u>
2,4-D	Aldrin	Xylol	Dissolved Arsenic
2,4,5-T	Dieldrin		
	Lindane		
	4,4'-DDT		
	4,4'-DDD		
	4,4'-DDE		

NOTE: Initial and verification ground water samples obtained from OWC-26 and OWC-27 will also be analyzed for chlordane, heptachlor, endrin, methoxychlor, and toxaphene. If the analytical results exhibit non-detectable levels of these analytes during these sampling events, they will be omitted from the quarterly ground water monitoring list of analytes.

TABLE 2

PARAMETERS FOR CHEMICAL ANALYSIS OF SOIL SAMPLES
FROM DRAINAGE DITCH/CONTAINMENT BASINPesticides
(Insecticides)

Aldrin
Dieldrin
Lindane
4,4-DDT
4,4-DDE
4,4-DDD
Chlordane
Heptachlor

Metals

Arsenic

NOTE:

1. Certain compounds have been deleted from the compound list because of the 1987 sampling results. Toxaphene, endrin, methoxychlor, ethylene thiourea, and 2,4-D were not detected in any of the 1987 soil samples. Maneb was detected in low concentrations (3 to 22 mg/kg) in only eight samples within a small area of the site. 2,4,5-T was detected in only three soil samples in 1987 at concentrations less than 1 mg/kg. Xylene has been deleted from the compound list because it is non-carcinogenic and selection of remedial alternatives for soil is expected to be controlled by other compounds.
2. Samples from the containment basin will also be analyzed for 2,4-D.

TABLE 3

PARAMETERS FOR CHEMICAL ANALYSIS OF AIR FILTERS/CARTRIDGES

Pesticides
(Insecticides)

Aldrin
Dieldrin
Lindane
4,4-DDT
4,4-DDE
4,4-DDD
Chlordane
Heptachlor

Metals

Arsenic

TABLE 4

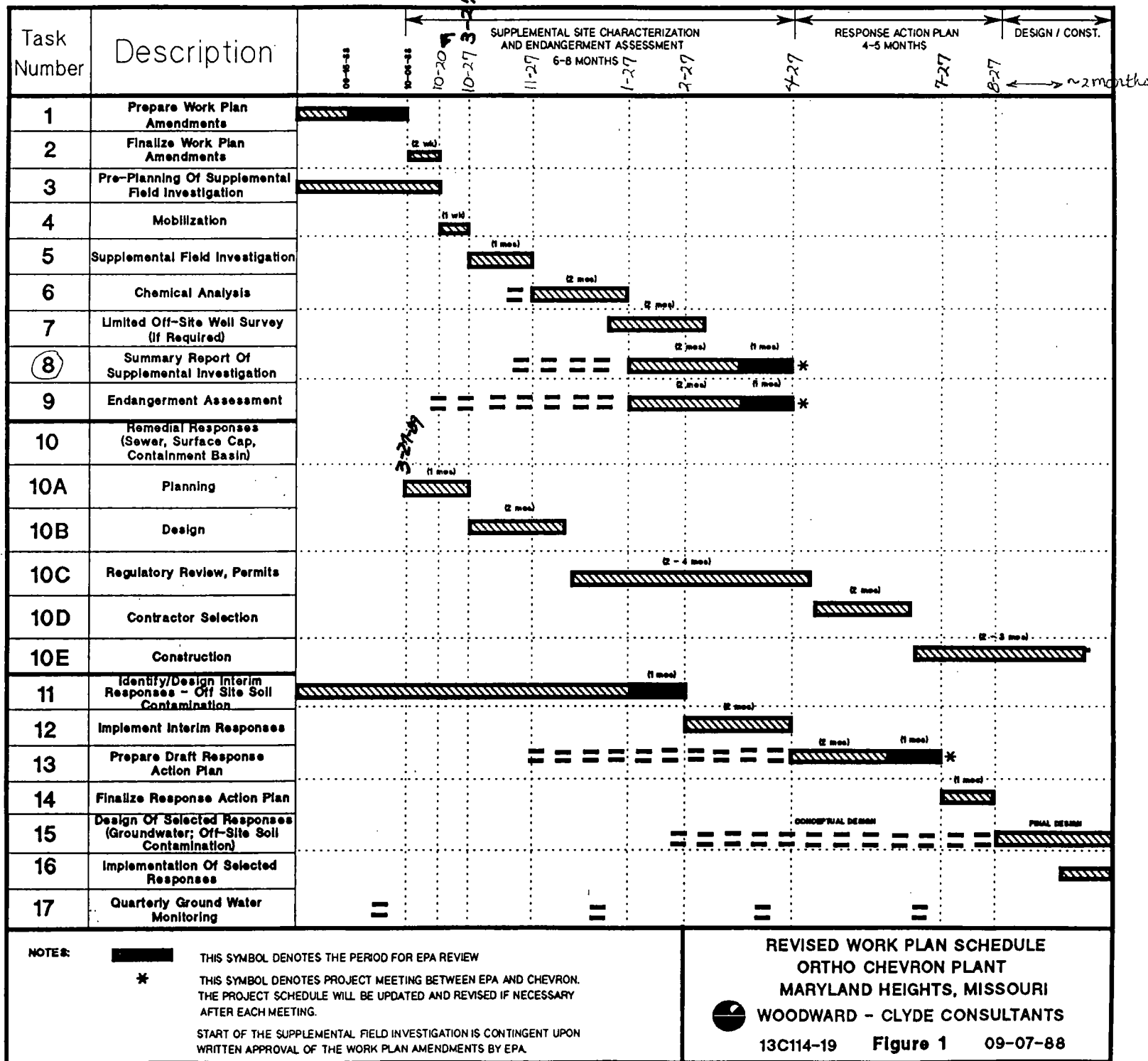
PARAMETERS FOR CHEMICAL ANALYSIS OF SOIL SAMPLES
FROM OFF-SITE SOIL BORINGS

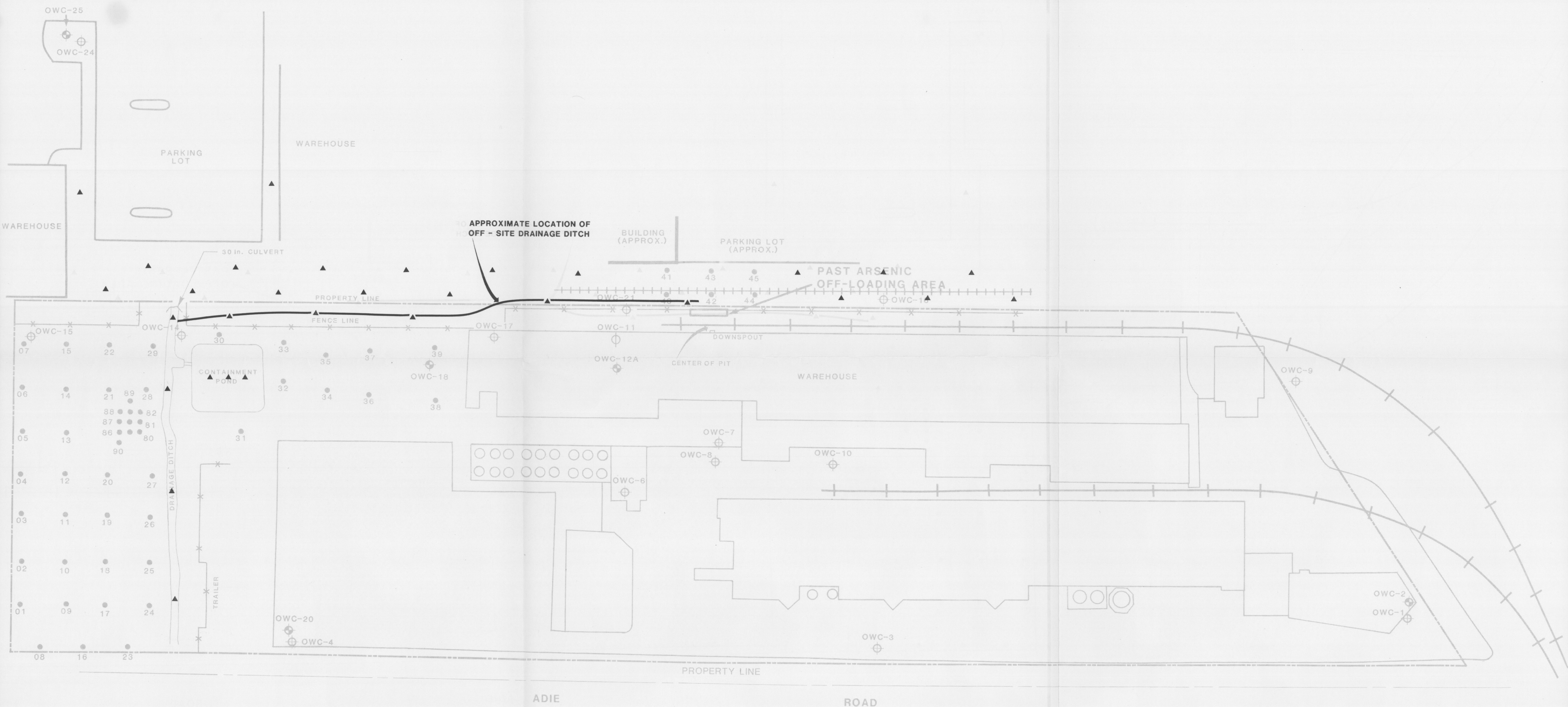
Pesticides
(Insecticides)

4,4'-DDT
4,4'-DDE
4,4'-DDD
Aldrin
Dieldrin
Chlordane
Heptachlor
Lindane

Metals

Arsenic





LEGEND

- ⊕ MONITORING WELL
- ⊕ DEEP MONITORING WELL
- ⊕ INACTIVE MONITORING WELL
- SOIL BORING (B87--)
- ▲ PROPOSED SOIL BORING

NOTE:

- 1) AREAS A AND B DEPICT THE CONTOUR LINE SHOWN ON FIGURE 3 WHERE THE ESTIMATED TOTAL PESTICIDES IN SOIL EXCEED 100 MG/KG
- 2) SAMPLE LOCATIONS WITHIN THE CONTAINMENT POND WILL BE SELECTED AT RANDOM UTILIZING A RANDOM NUMBER TABLE IN THE FIELD

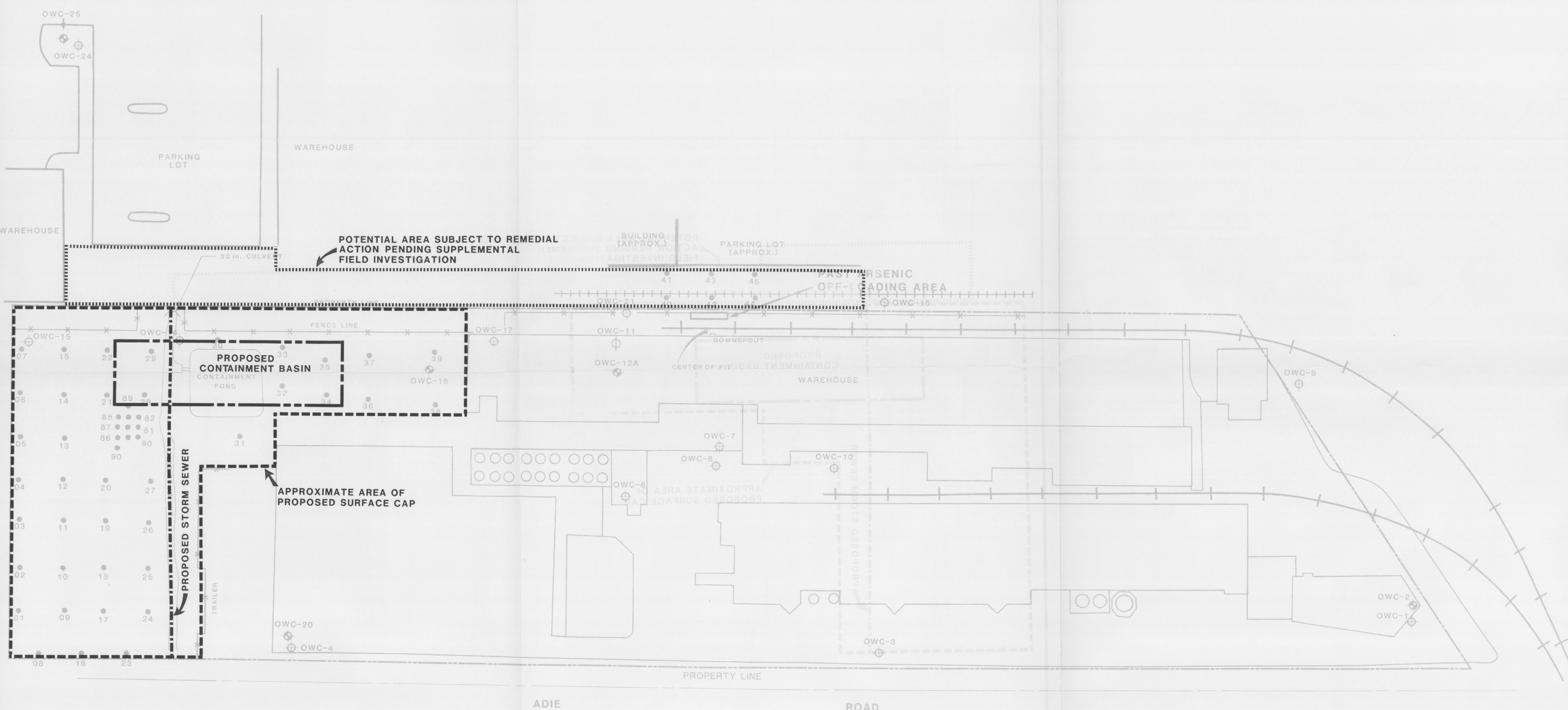
0 50 100
SCALE, FT.

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

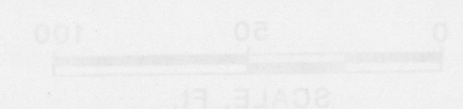
SUPPLEMENTAL FIELD INVESTIGATION
PROPOSED BORING LOCATIONS

DRN. BY SDC	DATE 8/23/88	PROJECT NO. 13C114-19	FIG. NO. 2
CHK'D BY WDS	DATE 8/23/88		



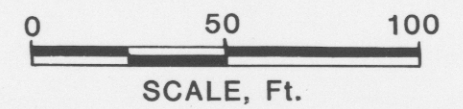
LEGEND

- ⊕ MONITORING WELL
- ⊕ DEEP MONITORING WELL
- ⊕ INACTIVE MONITORING WELL
- SOIL BORING (B87--)



LEGEND

- ⊕ MONITORING WELL
- ⊕ DEEP MONITORING WELL
- ⊕ INACTIVE MONITORING WELL
- SOIL BORING (B87--)



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PROPOSED SITE REMEDIATION

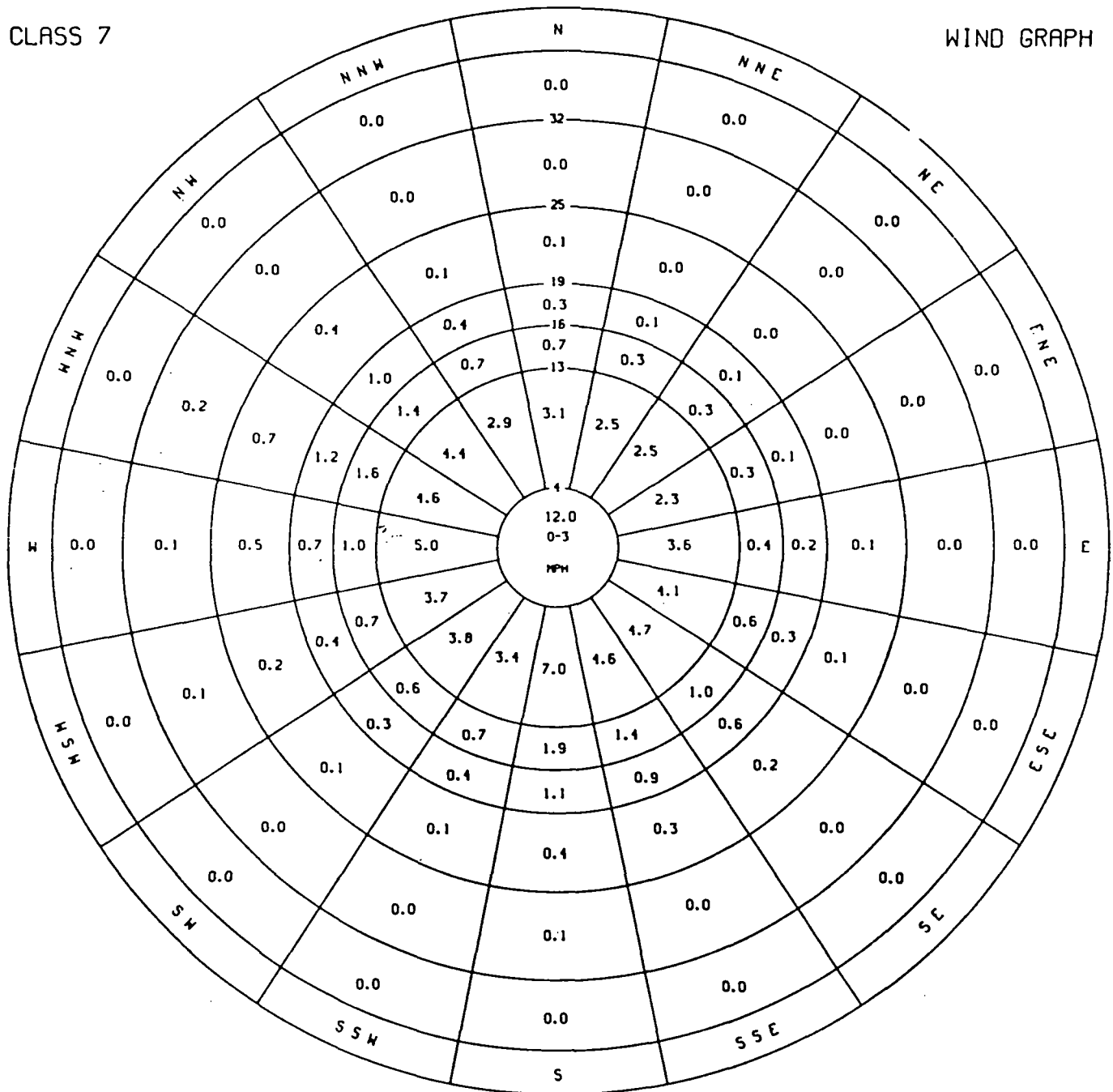
DRN. BY SDC	DATE 8/23/88	PROJECT NO. 13C114-19	FIG. NO. 3
CHK'D BY DCC	DATE 8/23/88		

STL ST LOUIS, MO

CEILING-VISIBILITY

CLASS 7

WIND GRAPH



**ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI**



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**WIND ROSE
ST. LOUIS, MISSOURI AND SURROUNDING AREA**

DRN. BY SDC	DATE 9/13/88	PROJECT NO.	FIG. NO.
CHK'D BY DCC	DATE 9/13/88	13C114-19	4

OFF-SITE MONITORING WELLS
OWC-24, OWC-25



EXISTING ROAD

EXISTING
BUILDING

EXISTING
BUILDING

EXISTING
BUILDING

SITE PROPERTY

ADIE ROAD

LEGEND



PAVED AREAS

● CANDIDATE WELL LOCATION

○ ALTERNATE WELL LOCATION



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PROPOSED MONITORING WELL LOCATIONS

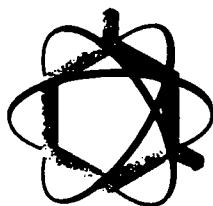
DRN. BY	SDC	DATE	8/23/88	PROJECT NO.	FIG. NO.
CHK'D BY	WDS	DATE	8/23/88	13C114-19	5

ATTACHMENT 1

QUALITY ASSURANCE MANUAL
metaTRACE, Inc.

Q U A L I T Y A S S U R A N C E M A N U A L

JULY 1987



**metaTRACE, Inc.
13715 Rider Trail, North
Earth City, MO 63045**

**The enclosed Quality Assurance Manual
is the work product of metaTRACE, Inc.**

FORWARD

metaTRACE, Inc. is committed to establishing an effective Quality Assurance/Control (QA/QC) Program. metaTRACE realizes the importance in planning and implementing the appropriate quality measures to ensure a quality product for metaTRACE's clients. This Quality Assurance Manual outlines the procedures and/or systems that metaTRACE incorporates to provide that "value-added" service.

I. Quality Assurance Policy

metaTRACE management is fully committed to an effective Quality Assurance/Quality Control (QA/QC) Program whose objective is the delivery of a quality product. The Quality Assurance Program works to provide complete, precise, accurate, representative data in a timely manner. In all cases, the end use of the product and the existing budget constraints are considered in planning and implementing quality measures.

Quality assurance is defined as the overall management system which operates to ensure that the quality control systems are functioning well. Quality assurance audits, interlaboratory comparisons, on-site systems audits, periodic evaluation of quality control procedures and data, and a corrective action system.

Quality control refers to the continuing routine checks on quality within each segment of project activity such as analysis, and data collection and handling. metaTRACE Standard Operating Procedures detail specific quality control procedures for these segments. They include such activities as periodic instrument calibrations, routine equipment maintenance, sample handling, edit tests with error diagnostics, etc.

II. Quality Assurance Organization

metaTRACE's Quality Assurance Program conforms with EPA and NIOSH recommendations and is directed by the QA Manager who reports directly to the Technical Director (see Figure 1) metaTRACE Organizational Chart thereby giving the QA Manager the necessary authority and independence to find and correct any existing quality problems. The QC Coordinator is responsible for the laboratory QC program; he reports to both the Technical Director and QA Manager.

metaTRACE's program includes Standard Operating Procedures, specific QA Project Plans, personnel training, QA audits and corrective action procedures. The program is designed to provide both continuity and flexibility in ongoing QC activities in all departments. Continuity, structure and direction are provided by the QA Manager and QC Coordinator: their responsibilities are outlined in this section.

A. QA Manager

The QA Manager is an employee of Alliance Technologies Corporation under contract to metaTRACE. He reports directly to the Technical Director and is, therefore independent of the laboratory operations. The QA Manager oversees the QA Program, selects

projects for audit and conducts audits of metaTRACE's and subcontractor work. He consults with the QC Coordinator on ongoing QC activities, reviews QA Project Plans, reviews work plans and reports for QA requirements, and initiates or follows up on corrective actions, as necessary. Revisions to the QA Manuals and specialized training sessions are coordinated by the QA Manager, through the laboratory QC Coordinator

B. QC Coordinator

A QC Coordinator is appointed by and reports to the Technical Director and is under the review of the QA Manager. The QC Coordinator is on staff to the Technical Director to ensure his independence from the technical staff generating data. The QC Coordinator is responsible for the QC program in the laboratory. He has the authority and responsibility to bring quality problems to the attention of the Technical Director and the QA Manager. The QA Manager meets individually with the QC Coordinator on a regular basis and on an ad hoc basis as appropriate. The QC Coordinator is responsible for maintaining awareness of active projects and their QC needs, providing QA/QC information to staff, coordinating technical review of reports, and providing a quarterly written report on QC activities to the Technical Director and QA Manager.

The QC Coordinator oversees and implements the ongoing laboratory Quality Control Program.

The QC Coordinator reports directly to both the Technical Director and the QA Manager. The duties of the Coordinator include:

- o reviewing new tasks and ensuring QA Project Plans are prepared as needed
- o reviewing Lab Coordination Sheets for compatibility of sampling and analytical procedures
- o supervising the operation of the QC Sample Bank
- o directing the preparation and inclusion of blind QC samples in the sample load in a fashion unrecognizable to the analysts
- o monitoring use of known QC samples, blanks and duplicates as required by individual programs

- o maintaining records of performance on known and blind QC samples as a measure of analytical precision and accuracy
- o maintaining an inventory of NBS and EPA reference materials for use as QC samples
- o ensuring that project problems are identified and corrective actions implemented
- o ensuring that QA sections are prepared for reports requiring them

C. Project Specific QA/QC Plans

metaTRACE's technical staff operates under the guidelines of the QA Program using appropriate procedures provided in the Standard Operating Procedures and the analytical method manuals. He ensures that even small projects have written QC procedures provided.

For larger projects or those with detailed QA/QC needs, a QA/QC Project Plan is prepared outlining QA requirements and providing specific QC procedures. These plans utilize procedures from metaTRACE's Standard Operating Procedures as appropriate, but they are specific to an individual project. A QA/QC Project Plan may contain sampling and analysis equipment calibration and maintenance procedures.

The Plan content is designed to incorporate the appropriate QC procedures and to meet client specifications. Most QA Project Plans are prepared according to the EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Plans," QAMS-005/80, U.S. Environmental Protection Agency, Washington, D.C. 1980. The QC Coordinator and the QA Manager have copies of this guideline document available.

These plans are subject to review and approval by the QA Manager.

D. Standard Operating Procedures

metaTRACE Standard Operating Procedures includes sections on general laboratory quality control, data recording and reporting, analytical instrument calibration and maintenance, sample identification and chain-of-custody.

The indexing format for the Standard Operating Procedures Manuals includes, at the top of each page, the following information:

- o Section: _____
- o Revision: _____
- o Date: _____
- o Page: __ of ____
- o Replaces: _____

"Section" identifies major three-digit sections;
 "Revision" represents the most current version of the section with the first version represented as "0";
 "Date" indicates the date of the most recent revision;
 and "Page" includes the number of the specific page and total number of pages in the section; "Replaces" indicates the most recent SOP section that the current revised SOP is replacing.

For each three-digit level or data form, the text begins on a new page. The format groups the pages together to allow convenient revision of the section or form. Even if only part of a section is revised, the whole section is given a new Revision Number and replaced in the handbooks. The Table of Contents is also updated so that it lists the most recent revision of each section or data form.

III. Elements of Quality Assurance

The following elements of quality assurance have been included in the design of metaTRACE's QA/QC Program:

- o Personnel Training
- o Document Control
- o Procurement Quality Control
- o Equipment Maintenance and Calibration
- o Preliminary or Pretest Preparation
- o Sample Handling
- o Sample Analysis
- o Intralaboratory and Interlaboratory Testing
- o Data Reporting
- o Data Validation
- o Statistical Analysis of Data

- o Audit Procedures
- o Corrective Action Procedures

The remainder of the Manual describes the general application of these quality control elements to meet metaTRACE's goal of producing quality data. Some individual Standard Operating Procedures (SOP) contain a more detailed discussion of the QA elements appropriate to that technical activity and include specific QC procedures.

A. Personnel Training

The objectives of QA training are to make metaTRACE's personnel aware of the importance of quality assurance and to inform them of the overall QA Program and their personal part in it. The significance of each person's job and performance is emphasized to foster personal involvement in the Program.

Employees are trained in their job operations so they can apply QC procedures to a sound base. Sampling and analysis programs involve complex technical procedures and precise following of directions, so special attention is given to on-the-job training for new employees, or to a staff member working with a procedure for the first time. The employee first studies the written technical procedures, performs the operations under the direct supervision of an experienced staff member and then, if appropriate, uses a standard or other QC sample to test his mastery of the procedure. The employee is told the results of the QC checks to help improve his performance, if necessary, and to develop a positive attitude on his part. In most cases, excellent results are quickly obtained and the employee takes pride in knowing he is performing well.

The Standard Operating Procedures are an important tool in this training, providing both an overview of policy and specific procedures to be followed. Under the direction of the QA Manager, the QC Coordinator works to have all staff members follow these procedures. Current procedure write ups are used to avoid word-of-mouth transfer of incorrect technical instructions. metaTRACE's QC Coordinator provides continuing information on quality assurance activities to all staff; technical seminars and training sessions are scheduled as appropriate.

B. Document Control

The varied activities of metaTRACE require many forms

of document control to provide completeness and traceability, clear sample identification and chain-of-custody information, confidentiality, current technical and QC procedure descriptions, and retrieval of information. Documents generated include computer programs, lab data sheets,, technical drawings, official project memos and reports. The Standard Operating Procedures address document control procedures appropriate to each technical work area; general information is provided in this section.

1. Measures to Ensure Completeness and Traceability

Notebooks and standardized data forms are used, and logs of gathered data and its sources are maintained to ensure completeness and traceability. Bound and paginated notebooks are used for laboratory analysis. The notebooks are page-numbered in single-or double-page versions; the page numbering ensures that data is not removed or added. Completed pages are dated and witnessed. The double-page books are used with carbon paper to provide a copy of the data. The Laboratory Standard Operating Procedures contain detailed sections on laboratory notebook use.

Standardized data forms are designed to gather the complete set of data needed for a particular technical activity. Telephone Conversation Reports, and Instrument Calibration Sheets are examples of the many types of data sheets used by metaTRACE's staff members. The standardized forms also ensure the comparability of data gathered by different people working on the same task.

Document control of data gathered from various sources is maintained by keeping a record or log of all the data. The log includes the title and/or description of each item, its source and/or author and the date it was received. It is useful to number each data item and provide a keyword or other very brief summary of the contents.

2. Chain-of-Custody Information

The documentation of sample identification and handling, and assignment of a responsible person are essential in many metaTRACE projects. Section:8 Sample Collection and Handling in this Manual discusses chain of-custody policies and the Standard Operating Procedures provide more detail. QA Project Plans include the specific custody forms to be used.

3. Confidentiality Procedures

A confidentiality requirement extends to the documents cited above. The Document control Coordinator ensures that metaTRACE makes every effort to provide and maintain confidentiality at all stages of the data handling. Certain EPA Programs require metaTRACE to obtain a security clearance to receive confidential business information specific to various other regulatory authorities. When these clearances are required under specific programs the appropriate procedures are submitted and metaTRACE employees then execute confidentiality agreements on a need to know basis. Specific security Standard Operating Procedures are prepared for these regulatory authorities and are available from the metaTRACE Document Control Coordinator.

4. Project Memos and Reports

The project manager is responsible for the control of all official memos and reports issued and for the completeness of the project file. Upon completion of a project, the document Control Coordinator is responsible for collecting all information pertaining to a specific project including but not limited to: raw data, copies of laboratory notebook pages, chain-of-custody records, sample bottle tags, notes, memos, telephone records of conversation, and interim and /or final reports and storing them in locked filing cabinets.

5. Project Document Inventory

Some projects require the compilation of a document inventory containing all project documents. EPA's National Enforcement Investigations Center (NEIC) has outlined requirements for this type of document control in two publications: "NEIC Policies and Procedures Manual" and "Enforcement Consideration for Evaluation of Uncontrolled Hazardous Waste Disposal Sites by Contractors."

metaTRACE follows the rigorous NEIC requirements when appropriate. They include the designation of a Document Control Coordinator and the identification of accountable documents. Preserialized sample identification tags and chain-of-custody records are used and a unique project code is used for all project documents.

6. Procurement Quality Control

In general, procurements fall into two classes-materials and services.

Materials

When applicable, Purchase Requisitions include quality requirements and these requirements are incorporated in the Purchase Order. Appropriate materials are subjected to acceptance tests or incoming inspection and records of these tests are maintained.

The requisitioning laboratory (GC, GC/MS, etc) is responsible for evaluating the quality of purchased materials and notifying the Operations Manager of any deficiency. The Operations Manager initiates Vendor Corrective Action if necessary.

Limited shelf life materials such as chemicals are identified and the expiration date noted on individual containers. Documentation of QC approved lots of reagents, QC check results, dates of receipt and expiration dates are maintained by the QC Coordinator.

Services

In addition to the control over procured materials, a rigorous program of procured services control is maintained. Any subcontractors employed by metaTRACE, Inc. are required to conform to metaTRACE's quality program. For example, if a service laboratory performs some analytical work under contract to metaTRACE, that laboratory must describe its QC procedures and submit documentation of the QC work performed. In addition, metaTRACE routinely incorporates QC samples (blanks, duplicates or samples whose true values are known to metaTRACE) in the sample load so that they are unrecognizable to the subcontractor. The results on these samples provide an independent measure of the quality of the subcontractor's work.

7. Equipment Maintenance and Calibration

For analytical laboratory activities, preventive maintenance includes attention to glassware, water supply, reagents and analytical balances as well as to more complex instrumentation. metaTRACE's quality control procedures for these components are detailed in specific standard operating procedures; instrument maintenance and calibration procedures are included.

8. Sample Collection and Handling

metaTRACE's Quality Control Coordinator (QCC) will coordinate with the field sampling crews to assure that standard methods of collection are being implemented. This includes the appropriate sample containers, preparation and preservation of all samples along with any specific quality control

requirements.

Chain-of-custody procedures related to samples which are collected for laboratory analysis will be initiated by the field crew. The purpose of these procedures is to document the identity of each sample and its handling, from its first existence as a sample until all laboratory analysis has been completed and, if appropriate, the information derived from the sample that has been introduced as evidence in litigation. metaTRACE's Standard Operating Procedures discuss these chain-of-custody procedures in more detail.

All samples submitted to metaTRACE's laboratories are brought to the Sample Custodian who establishes or continues the chain-of-custody by assigning a metaTRACE Control Number to each sample which identifies it through all further handling. The sample is recorded in the Master Log under this Number and the Control Number is written on the sample container. An internal chain-of-custody record is initiated for each sample and each handling of the sample is documented on that record.

metaTRACE maintains large, locked, refrigerated and nonrefrigerated storage areas with provisions for hazardous material storage. After necessary preservation of subdivision, the Sample Custodian stores each sample in the appropriate area, filed under its metaTRACE Control Number. Records are maintained of sample transfer within the laboratory. Samples which will not be analyzed by metaTRACE's laboratories are handled in essentially the same way with the Project Manager responsible for notifying the Sample Custodian of receipt of samples. Samples transferred to an outside laboratory are accompanied by a custody record.

9. Sample Preparation

Sub-sampling will be done on a well-mixed sample. Exercising caution to remove or avoid twigs and rocks in all soil sub-sampling procedures. All sub-sampling aliquots will be as large as the method allows to ensure a representative sample.

If metaTRACE receives any samples that have not been previously filtered in the field, as required then samples will be passed through a 0.45 micron glass fiber filter.

All dilutions will be carried out as serial dilutions using volumetric pipets and flasks. Any dilution

greater than 1:100 will be carried out in multiple steps to decrease dilution errors. Preparation and use of calibration standards is outlined in metaTRACE's SOP's.

10. Sample Analysis

metaTRACE, Inc. conducts a wide variety of analyses requiring reliable chemical procedures. The individual laboratories perform all of these analyses using the appropriate elements of quality assurance in the programs as documented in specific standard operating procedures.

11. Laboratory Analysis Quality Control

Standard Operating Procedures document QC procedures which are implemented by the entire laboratory staff with direction from the QC Coordinator. The QC Coordinator reports to both the Technical Director and the QA Manager and is therefore independent of the technical sections of the laboratory. Written analytical procedures are contained in several methods manuals; specialized project method manuals are prepared when appropriate.

Limits of detection are determined as outlined in SOP G034. The MDL's obtained by this procedure are used to judge the significance of a single measurement and is designed for a broad variety of physical and chemical methods.

12. Intralaboratory/Interlaboratory Testing

metaTRACE makes use of intralaboratory testing to achieve the best possible performance within its own laboratories and interlaboratory testing to compare that performance with other laboratories.

Intralaboratory testing is performed to demonstrate that the analytical system is in control, to identify any sources of error within the measurement method, and to establish the precision and accuracy of the method.

metaTRACE uses a laboratory blank prepared according to the specific method and matrix requirements. Method blanks are run with every analysis batch; they aid in demonstrating good control, or in investigating problems. Some of the potential sources of error are the operator or analyst, equipment, calibration, or the operating conditions.

metaTRACE uses Laboratory Control Standards (LCS), and/or spiked blank whose true values are known to the analyst to establish that the analytical procedure is in control. A laboratory control standard is a blank into which a known amount of the analyte(s) of interest is(are) spiked. Samples must be tied to the LCS by means of a date or batch identifier. Recorded data generated by the analysis of the LCS will be used to construct a control chart (see Attachment 2) and control limits will be established. After analysis of each batch of samples, the analyst must check the appropriate control chart to ensure that the analysis value for the LCS falls within the control limits for that method. If the LCS exceeds the control limits, corrective action is taken; no further samples are analyzed until analysis of an LCS shows the methodology is in control.

A surrogate standard is a mixture of compounds spiked into all samples unless a specific exception is made in the method itself. The surrogate standard has applications to organic analytes determined by GC & GC/MS procedures and may be used to determine recoveries and therefore matrix interferences.

A matrix spike is an environmental sample spiked with the compounds of interest or a representative cocktail of these compounds. The matrix spike is used to determine the effect of the matrix on recovery, rather than as a control sample. The matrix spike has applications to inorganic and organic analyses and may be used to determine chemical recoveries from the environmental matrix.

Precision is determined on replicate samples; if these replicate samples are standard reference materials, accuracy can be determined at the same time. Acceptance limits are established using the range between the duplicates.

During analysis, if the range of a set of duplicates falls beyond the control limit, the data will be regarded as unreliable. Immediate corrective action will be taken and the analyses repeated. Matrix spike and matrix spike duplicate samples per CLP protocol will be used to satisfy the duplicate criteria for GC and GC/MS analyses.

Quality Control criteria for GC and GC/MS analyses, when not CLP protocol, will be determined by windows established from such analyses performed using the type of quality control frequencies listed below.

Frequency of all quality control analyses will be performed as outlined in the chart below.

<u>TYPE</u>	<u>FREQUENCY¹</u>	<u>CONTROL</u>
<u>ORGANIC ANALYSES</u>		
Blank	1	Surrogate Compounds
LCS and/or Spiked Blank	1	% Recovery, analytes of interest
Duplicate	1	RPD
Matrix Spike	1	% Recovery of target analyte(s)
Matrix Spike Dup.(²)	1	RPD and % Recovery
<u>INORGANIC ANALYSES</u>		
Blank	1	No contamination
LCS and/or Spiked Blank	1	% Recovery, analytes of interest
Duplicate	1	RPD
Matrix Spike(²)	1	% Recovery of target analyte(s)

Blind QC samples are periodically inserted into a sequence of samples by the QCC. Blind QC samples are prepared by the QCC or designee independently from the laboratory operations staff and serve as an independent check on the analyst's performance. Blind QC samples may be obtained from reference materials purchased from the EPA, NBS, ERA or any other certified quality control source. Blind QC samples can also be prepared from sample splits or previously analyzed samples of known concentrations under the guidance and control of the QCC. They are initiated into metaTRACE's chain-of custody routine as a normal sample and handled as such until analysis and reporting of results is complete.

Interlaboratory tests are designed to compare the performance of several laboratories. Usually, identical sample sets are submitted to a relatively

¹ Frequency is based a batch of 20 samples or less of a similar matrix or whenever samples are extracted, whichever is more frequent.

² MS/MSD analyses will be performed per client request.

A coordinating lab received all the results and summarized the data so that any participating laboratory can evaluate and improve its own performance. metaTRACE laboratories participate regularly in Water Supply Performance Evaluations; Water Pollution Performance Surveys; Asbestos Bulk Sample Analysis QA Program; and specialized audit programs such as that for Level 1 Environmental Assessment analyses. Both internal staff members and the QC Coordinator evaluate the results; if any results are not within the control limits established by the coordinating laboratory, corrective action is initiated at metaTRACE.

13. Data Reporting

Procedures for recording and reviewing data at several levels are used at metaTRACE to minimize human and automated data handling errors.

a) Manual Recording

Standard Operating Procedures describes the QC procedures used for laboratory notebooks and includes data worksheets which are routinely used in the reduction of quantitative instrument data to a report format expressed in terms of concentration. This instrumental data is then entered on summary worksheets.

Data gathering tabulation forms are designed to be complete, appropriate, and to include checks on the reasonableness of responses. Care in entering and transcribing responses is emphasized.

b) Automated Recording

Many of analytical measurements made by metaTRACE staff members are automatically recorded; e.g., complex analytical instruments (Hewlett-Packard 5988 and 5995 GC/MS systems, Jarrell-Ash 855 ICP, etc.) have their own computerized data systems. metaTRACE instrument checklists include checks on the operation of these data handlers and internal validity checks are used to flag data resulting from electronic interferences.

c) Calculation of Results

Whenever possible, calculations are computerized for efficiency and to avoid human error. The analytical data systems mentioned above calculate results as programmed and provide hard copy in the desired format. In all cases, computerized data are verified for error control, and careful handling of computer storage peripherals is stressed. Tests are built into the programs to

trap transcription errors or missing items, and acceptance limits are included in computerized systems when appropriate. The record of the run contains the calculation results, and the input data. Analytical results are reduced to the correct number of significant figures for the measurement technique.

d) Data Review

The analyst and data gatherer should be alert to the importance of the data they are recording. Acceptance limits are provided to help the operator spot questionable data and control charts are used whenever possible to show if the procedure is in control.

The Quality Control Coordinator initiates control charts for instrument performance and specific analytical methods, and reviews routine and specialized QC sample results as they pertain to each project.

In the laboratory, the Project Manager and the Operations Manager review data promptly to ensure its reasonableness and determine if corrective action is needed.

e) Data Validation

Data validation is the process of filtering data and accepting or rejecting it on the basis of sound criteria. metaTRACE supervisory and QC personnel use validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data are maintained even those judged to be "outlying" or spurious values.

Usually acceptance limits or control chart control limits are used as the rejection criteria. The QA Project Plan states the number of data items to be validated, the allowable number of errors and further action to be taken when an error is found. Analytical data is validated using the following general criteria:

- o Documentation of sample identity and handling, e.g., preservation, and required analyses
- o Use of approved analytical procedures
- o Use of QC checked reagents
- o Use of known QC samples (LCS) to ensure analytical system was in control
- o Analysis of required blanks, duplicated and blind QC samples completed

- o Precision and accuracy achieved on replicate and blind QC samples

The experience of the laboratory staff is relied on for judgment; questionable results are noted and investigated but not usually rejected. As noted in Section 12.e the laboratory QC personnel perform this validation in their review of data reports.

Manual data validation criteria apply to computerized data also. Acceptance limits are used when enough experience and information on analyzing the same type of samples exists. Programed checks on the reasonableness of gathered or previously existing data used for planning and analysis projects aid in validating the data. The computer programs contain edit checks to be sure the proper information is entered, and provide for easy correction of mistakes. The input values and error messages are provided with the calculated results for ease in checking.

QC and supervisory personnel validate all computerized data; the QA Manger may audit the validation by running a dummy set of data through the computer. The Project Manager is consulted for technical judgment if a validity question is found.

14. Statistical Analysis of Data

Statistical tools and techniques are used with discretion to aid in the analysis of collected data. The Project Manager defines the type and extent of statistical analysis to be performed for each project.

Computerized statistical treatment is facilitated by use of the appropriate routines. QA/QC samples are analyzed statistically to derive the maximum benefit from their use; frequently used statistical techniques are briefly described in this section.

a) Frequency distribution

The frequency distribution is a means of presenting data in a form which makes clear the central tendency and the dispersion of the data. Plotting these histograms of the data points or using probability graph paper establishes the type of distribution present; it is necessary to know how data are distributed to correctly choose other statistical tools. In sampling and analysis, the most frequently encountered continuous distributions are normal and

lognormal. Most QC samples are normally distributed.

b) Mean, Standard Deviation, Coefficient of Variation

These summary statistics are used to simplify the presentation of data and are especially useful in evaluating quality control samples. The accuracy achieved on QC samples is evaluated by comparing the mean of repeated measurements with the known value of the reference material; the precision achieved is shown by the standard deviation and coefficient of variation.

The mean is a location parameter which describes the central tendency of the data; the arithmetic mean is used unless the data is known to be lognormally distributed. In that case, the geometric mean is used. The standard deviation and coefficient of variation (relative standard deviation) are measures of the dispersion of the data. The range between the largest and the smallest value in a small set of data ($2 \leq n \leq 8$) sometimes used instead of the standard deviation, especially in Shewhart Control Charts.

c) Identification and Treatment of Outliers

A data point which deviates markedly from others in its set of measurements may be referred to as an outlier. The outlier may result from an error in the measurement system or technique or, it may be a valid value due to unique circumstances at the time of sampling, analysis, or data collection. The suspected outlier value is recorded and retained in the data set while it is investigated. There is a great reluctance to reject an observation even if confirmed as an outlier.

The laboratory notebook should indicate any unique circumstances which occurred during analysis. It is useful to also perform a simple statistical test on suspected outliers, metaTRACE staff members usually use one or both of the following tests to identify outliers. Dixon's test for extreme observations is an easily computed procedure for determining whether a single, very large, or very small value is consistent with the remaining data. The one-tailed t test for difference may also be used in this case. If the suspect value is statistically identified as an outlier, further investigation is initiated. The operator, analyst, or data gatherer who worked with the sample is consulted for his knowledge of the specific sample and his experience with the similar samples. This may

give an experimental reason for the outlier and a decision can then be made as to whether the outlying value should be kept in the data set. Further statistical analyses are performed with and without the outlier to determine its effect on the conclusions. In many cases, two data sets will be reported, one including and one excluding the outlier.

In summary, every effort is made to include the outlying value in the reported data. If the value is rejected, it is identified as an outlier, reported with its data set and its omission is noted.

d) Regression analysis

Regression analysis is a statistical technique for estimating the parameters of an equation relating a particular set of variables to another set of variables. Least-squares linear regression is widely used in analytical work to relate concentration values to instrument readings.

This statistical technique minimizes the sum of the squares of the deviations of the data points from the straight line of best fit, and gives the parameters of the linear regression equation. The correlation coefficient indicates how well the data actually fits the least-squares line.

15. Control Charts

The control chart displays data in a form which graphically compares the variability of all test results with the average or expected variability of small groups of data. The variability may be due to random (indeterminate) or to assignable (determinate) causes. The control chart distinguishes indeterminate from determinate variation in a process or method by its control limits. If a value falls outside the control limits, it is considered out-of-control, almost certainly due to a determinate cause which has been added to the indeterminate variations. The control chart signals the need to investigate, find the determinate cause and correct it. metaTRACE uses the Shewhart type of chart with control limits defined by the client, or calculated on the basis of the mean plus or minus 2 or 3 times the standard deviation of the statistic used. If only indeterminate variations are occurring and control limits are set at plus or minus 2 standard deviations, 95.5 percent of the plotted values will fall within the control limits. If plus or minus 3 standard deviations from the mean are used as control limits, 99.7 percent of the

plotted values fall within these limits. When this happens, the process or method is considered in control. Construction of a control chart requires a minimum of 14 to 20 duplicate sets of data points which limits its use somewhat. Quality control samples and instrument calibrations lend themselves most readily to the gathering of the data. metaTRACE uses X, R charts for plotting accuracy and precision of analytical QC samples. Calculation of control limits and the values are usually plotted chronologically so that trends or cycles can be readily detected. If QC sample measurements show an out-of-control condition, it can be expected that subsequent sample analyses might yield invalid data. The control chart is an effective indicator of the need for corrective action.

16. Audit Procedures

metaTRACE's Quality Assurance Program includes both performance and system audits as independent checks of the quality of data obtained from laboratory analysis, and data gathering activities. Every effort is made to have the audit assess the measurement process in normal operation. Audits of assembly or inspection procedures are conducted during instrument manufacture. Either type of audit may show the need for corrective action.

17. Performance Audits

The analysis and data handling segments of a project are checked in performance audits. The QC Coordinator ordinarily arranges the audits so they are unknown to the project staff, or a different operator/analyst performs the audit operation to ensure the independence of the quantitative results. The auditing frequency is outlined in the QA Project Plan and is based on past experience with particular sampling and analysis procedures, client guidelines and project needs. An audit rate ranging from 5 to 10 percent is commonly used and results are plotted on control charts to permit continuous, rapid evaluation of quality control effectiveness. Reference standards may be randomly dispersed among samples awaiting analysis to check the analytical procedure. Data handling is checked by using the original raw data and performing all necessary calculations and entry of data. The audit results are recorded and compared with routinely obtained data.

18. System Audits

This qualitative review checks that the QC measures outlined in the QA Project Plan are in use; it is a general overview of the whole quality system for that project. The QA Manager usually conducts a system audit onsite at the start of a program. A qualitative review of analytical work is usually conducted at metaTRACE's facility; however, the QA Manager is experienced in auditing subcontractor work at other locations.

19. Corrective Action Procedures

Perhaps the single most important part of any quality assurance program is a well-defined, effective policy for correcting quality problems. metaTRACE maintains a closed-loop corrective action system under the direction of the QA Manager with full management support. While the entire Quality Assurance Program operates to prevent problems, it also serves to identify and correct those that may exist. Usually these quality problems require either on-the-spot immediate corrective action or long-term corrective action.

20. Immediate Corrective Action

Instrument and equipment malfunctions and associated repairs are most amenable to immediate corrective action by the analyst, before erroneous data is generated. metaTRACE's quality control procedures incorporate method or equipment specific operating ranges or instrument tuning and/or calibration procedures designed to define instrument or equipment performance. Analysts are responsible for ensuring that each piece of equipment and instrument meets method or manufacturer required criteria prior to sample analyses. When any equipment or instrument fails to meet established criteria, the cause of the failure is investigated and corrected. This may simply mean retuning or recalibrating the instrument or it may involve disassembly and cleaning or replacement of defective parts. metaTRACE maintains service contracts on major instrumentation as a precaution against major instrument down time. All instrument repairs are recorded in individual laboratory maintenance notebooks. These everyday evaluations and corrective actions are part of the QA/QC system. Other QC problems do not lend themselves to this type of immediate corrective action. The following subsections discuss metaTRACE's system for effectively handling these long-term actions.

21. Long-Term Corrective Action

Any quality control problem identified by standard QC procedures, control charts, performance or system audits which cannot be resolved by immediate corrective action falls into the long-term category. metaTRACE uses established QC parameters to identify out-of-control situations, identifies procedure to ensure that out-of-control situations are reported to appropriate supervisory personnel who are responsible for ensuring that the problem is corrected as part of a closed-loop action. The essential steps in the metaTRACE closed-loop corrective action system are:

- o Identify the out-of-control situation. This is best accomplished through the daily review of established Quality Control charts which define acceptable method performance.
- o Assign responsibility for investigating the problem.
- o Investigate the cause of the out-of-control situation and identify affected data.
- o Determine a corrective action plan to eliminate the problem. Action plans may require changes or additional standard operating procedures, additional training for personnel involved, or maintenance or repair of equipment or instrumentation.
- o Assign responsibility and implement the corrective action plan.
- o Monitor and evaluate data to establish the effectiveness of the corrective action.
- o Verify that the chosen corrective action plan has eliminated the out-of-control problem. Reanalyze effected samples and report data.

Documentation of the problem is important to the system. A Corrective Action Report is completed by the person finding the quality problem and submitted to the QC Coordinator immediately. This report identifies the problem, possible causes and the person responsible for action on the problem. The responsible person may be an analyst, QC Coordinator or the QA Manager. If no person is identified as responsible for action, the QC Coordinator investigates the situation and determines who is responsible.

The Corrective Action Report includes a description of the corrective action planned and the date it was initiated, and space for follow-up. The QC Coordinator checks to be sure that the initial action is appropriate and has been implemented and, at appropriate later dates, checks again to see if the problem has been fully solved. The report aids the QA Manager in follow-up and makes any quality problems visible to management; and may also prove valuable in listing a similar problem and its solution. This system has proved quite effective in handling sequential types of corrective action since it brings to the QA Manager's attention at a time appropriate to check on the next stage of corrective action.

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7/16/87
Date

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7-16-87
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ATTACHMENT 2

EPA METHOD T04, METHOD FOR THE DETERMINATION
OF
ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED
BIPHENYLS IN AMBIENT AIR

METHOD FOR THE DETERMINATION OF ORGANOCHLORINE PESTICIDES
AND POLYCHLORINATED BIPHENYLS IN AMBIENT AIR

1. Scope

- 1.1 This document describes a method for determination of a variety of organochlorine pesticides and polychlorinated biphenyls (PCBs) in ambient air. Generally, detection limits of $>1 \text{ ng/m}^3$ are achievable using a 24-hour sampling period.
- 1.2 Specific compounds for which the method has been employed are listed in Table 1. Several references are available which provide further details on the development and application of the method. The sample cleanup and analysis methods are identical to those described in U. S. EPA Method 608. That method is included as Appendix A of this methods compendium.

2. Applicable Documents

- 2.1 ASTM Standards
D1356 Definition of Terms Related to
Atmospheric Sampling and Analysis (7).
- 2.2 Other Documents
Ambient Air Studies (1-3)
U. S. EPA Technical Assistance Document (4).
U. S. EPA Method 608 (5). See Appendix A of methods
compendium.

3. Summary of Method

- 3.1 A modified high volume sampler consisting of a glass fiber filter with a polyurethane foam (PUF) backup absorbent cartridge is used to sample ambient air at a rate of $\sim 200\text{-}280 \text{ L/minute}$.

- 3.2 The filter and PUF cartridge are placed in clean, sealed containers and returned to the laboratory for analysis. The PCBs and pesticides are recovered by Soxhlet extraction with 5% ether in hexane.
- 3.3 The extracts are reduced in volume using Kuderna-Danish (K-D) concentration techniques and subjected to column chromatographic cleanup.
- 3.4 The extracts are analyzed for pesticides and PCBs using gas chromatography with electron capture detection (GC-ECD), as described in U. S. EPA Method 608 (5).

4. Significance

- 4.1 Pesticides, particularly organochlorine pesticides, are widely used in both rural and urban areas for a variety of applications. PCBs are less widely used, due to extensive restrictions placed on their manufacture. However, human exposure to PCBs continues to be a problem because of their presence in various electrical products.
- 4.2 Many pesticides and PCBs exhibit bioaccumulative, chronic health effects and hence monitoring ambient air for such compounds is of great importance.
- 4.3 The relatively low levels of such compounds in the environment requires the use of high volume sampling techniques to acquire sufficient sample for analysis. However, the volatility of these compounds prevents efficient collection on filter media. Consequently, this method utilizes both a filter and a PUF backup cartridge which provides for efficient collection of most organochlorine pesticides, PCBs, and many other organics within the same volatility range.

5. Definitions

Definitions used in this document and any user-prepared SOPs should be consistent with ASTM D1356 (7). All abbreviations

and symbols are defined within this document at the point of use.

6. Interferences

- 6.1 The use of column chromatographic cleanup and selective GC detection (GC-ECD) minimizes the risk of interference from extraneous organic compounds. However, the fact that PCBs as well as certain organochlorine pesticides (e.g. toxaphene and chlordane) are complex mixtures of individual compounds can cause difficulty in accurately quantifying a particular formulation in a multiple component mixture.
- 6.2 Contamination of glassware and sampling apparatus with traces of pesticides or PCBs can be a major source of error in the method, particularly when sampling near high level sources (e.g. dumpsites, waste processing plants, etc.) careful attention to cleaning and handling procedures is required in all steps of the sampling and analysis to minimize this source of error.

7. Apparatus

- 7.1 Hi-Vol Sampler with PUF cartridge - available from General Metal Works (Model PS-1). See Figure 1.
- 7.2 Sampling Head to contain glass cartridge with PUF plug - available from General Metal Works. See Figure 2.
- 7.3 Calibration orifice - available from General Metal Works.
- 7.4 Manometer - to use with calibration orifice.
- 7.5 Soxhlet extraction system - including Soxhlet extractors (500 and 250 mL), heating mantels, variable voltage transformers, and cooling water source - for extraction of PUF cartridges before and after sampling. Also for extraction of filter samples.
- 7.6 Vacuum oven connected to water aspirator - for drying extracted PUF cartridges.
- 7.7 Gas chromatograph with electron capture detector - (consult U. S. EPA Method 608 for specifications).

- 7.8 Forceps - to handle quartz fiber filter samples.
- 7.9 Die - to cut PUF plugs.
- 7.10 Various items for extract preparation, cleanup, and analysis - consult U. S. EPA Method 608 for detailed listing.
- 7.11 Chromatography column - 2 mm I.D. x 15 cm long - for alumina cleanup.

8. Reagent and Materials

- 8.1 Polyurethane foam - 3 inch thick sheet stock, polyether type used in furniture upholstery. Density 0.022 g/cm^3 .
- 8.2 Polyester gloves - for handling PUF cartridges and filters
- 8.3 Filters, quartz fiber - Pallflex 2500 QAST , or equivalent.
- 8.4 Wool felt filter - 4.9 mg/cm^2 and 0.6 mm thick. To fit sample head for collection efficiency studies. Pre-extracted with 5% diethyl ether in hexane.
- 8.5 Hexane - Pesticide or distilled in glass grade.
- 8.6 Diethyl ether - preserved with 2% ethanol - distilled in glass grade, or equivalent.
- 8.7 Acetone - Pesticide or distilled in glass grade,
- 8.8 Glass container for PUF cartridges.
- 8.9 Glass petri dish - for shipment of filters to and from the laboratory.
- 8.10 Ice chest - to store samples at $\sim 0^\circ\text{C}$ after collection.
- 8.11 Various materials needed for extract preparation, cleanup, and analysis - consult U. S. EPA Method 608 for details (Appendix A of this compendium).
- 8.12 Alumina - activity grade IV. 100/200 mesh

9. Assembly and Calibration of Sampling Apparatus

9.1 Description of Sampling Apparatus

- 9.1.1 The entire sampling system is diagrammed in Figure 1.
This sampler was developed by Syracuse University

Research Corporation (SURC) under a U. S. EPA contract (6) and further modified by Southwest Research Institute and the U. S. EPA. A unit specifically designed for this method is now commercially available (Model PS-1 - General Metal Works, Inc., Village of Cleves, Ohio). The method writeup assumes the use of the commercial device, although the earlier modified device is also considered acceptable.

- 9.1.2 The sampling module (Figure 2) consists of a glass sampling cartridge and an air-tight metal cartridge holder. The PUF plug is retained in the glass sampling cartridge.

9.2 Calibration of Sampling System

- 9.2.1 The airflow through the sampling system is monitored by a venturi/Magnehelic assembly, as shown in Figure 1. A multipoint calibration of the venturi/magnehelic assembly must be conducted every six months using an audit calibration orifice, as described in the U. S. EPA High Volume Sampling Method (8). A single point calibration must be performed before and after each sample collection, using the procedure described below.
- 9.2.2 Prior to calibration a "dummy" PUF cartridge and filter are placed in the sampling head and the sampling motor is activated. The flow control valve is fully opened and the voltage variator is adjusted so that a sample flow rate corresponding to $\sim 110\%$ of the desired flow rate is indicated on the magnehelic (based on the previously obtained multipoint calibration curve). The motor is allowed to warmup for ~ 10 minutes and then the flow control valve is adjusted to achieve the desired flow rate. The ambient temperature and barometric pressure should

be recorded on an appropriate data sheet (e.g. Figure 3).

9.2.3 The calibration orifice is then placed on the sampling head and a manometer is attached to the tap on the calibration orifice. The sampler is momentarily turned off to set the zero level of the manometer. The sampler is then switched on and the manometer reading is recorded, once a stable reading is achieved. The sampler is then shut off.

9.2.4 The calibration curve for the orifice is used to calculate sample flow from the data obtained in 9.2.3, and the calibration curve for the venturi/magnehelic assembly is used to calculate sample flow from the data obtained in 9.2.2. The calibration data should be recorded on an appropriate data sheet (e.g. Figure 3). If the two values do not agree within 10% the sampler should be inspected for damage, flow blockage, etc. If no obvious problems are found the sampler should be recalibrated (multi-point) according to the U. S. EPA High Volume Sampling procedure (8).

9.2.5 A multipoint calibration of the calibration orifice, against a primary standard, should be obtained annually.

10. Preparation of Sampling (PUF) Cartridges

10.1 The PUF adsorbent is a polyether-type polyurethane foam (density No. 3014 or 0.0225 g/cm^3). This type of foam is used for furniture upholstery. It is white and yellows on exposure to light.

10.2 The PUF inserts are 6.0 cm diameter cylindrical plugs cut from 3 inch sheet stock and should fit with slight compression in the glass cartridge, supported by the wire

screen. See Figure 2. During cutting the die is rotated at high speed (e.g. in a drill press) and continuously lubricated with water.

- 10.3 For initial cleanup the PUF plug is placed in a Soxhlet extractor and extracted with acetone for 14-24 hours at approximately 4 cycles per hour. When cartridges are reused, 5% diethyl ether in n-hexane can be used as the cleanup solvent.
- 10.4 The extracted PUF is placed in a vacuum oven connected to a water aspirator and dried at room temperature for approximately 2-4 hours (until no solvent odor is detected).
- 10.5 The PUF is placed into the glass sampling cartridge using polyester gloves. The module is wrapped with hexane rinsed aluminum foil, placed in a labeled container and tightly sealed.
- 10.6 Other adsorbents may be suitable for this method as indicated in the various references (1-3). If such materials are employed the user must define appropriate preparation procedures based on the information contained in these references.
- 10.7 At least one assembled cartridge from each batch must be analyzed, as a laboratory blank, using the procedures described in Section 12, before the batch is considered acceptable for field use. A blank level of <10 ng/plug for single compounds is considered to be acceptable. For multiple component mixtures (e.g. Arochlors) the blank level should be <100 ng/plug.

11. Sampling

- 11.1 After the sampling system has been assembled and calibrated as described in Section 9 it can be used to collect air samples as described below.
- 11.2 The samples should be located in an unobstructed area, at least two meters from any obstacle to air flow. The exhaust hose should be stretched out in the downwind

direction to prevent recycling of air.

- 11.3 A clean sampling cartridge and quartz fiber filter are removed from sealed transport containers and placed in the sampling head using forceps and gloved hands. The head is tightly sealed into the sampling system. The aluminum foil wrapping is placed back in the sealed container for later use.
- 11.4 The zero reading of the Magnehelic is checked. Ambient temperature, barometric pressure, elapsed time meter setting, sampler serial number, filter number and PUF cartridge number are recorded. A suitable data sheet is shown in Figure 4.
- 11.5 The voltage variator and flow control valve are placed at the settings used in 9.2.3 and the power switch is turned on. The elapsed time meter is activated and the start time recorded. The flow (Magnehelic setting) is adjusted, if necessary using the flow control valve.
- 11.6 The Magnehelic reading is recorded every six hours during the sampling period. The calibration curve (Section 9.2.7) is used to calculate the flow rate. Ambient temperature and barometric pressure are recorded at the beginning and end of the sampling period.
- 11.7 At the end of the desired sampling period the power is turned off and the filter and PUF cartridges are wrapped with the original aluminum foil and placed in sealed, labeled containers for transport back to the laboratory.
- 11.8 The Magnehelic calibration is checked using the calibration orifice as described in Section 9.2.4. If the calibration deviates by more than 10% from the initial reading the flow data for that sample must be marked as suspect and the sampler should be inspected and/or removed from service.
- 11.9 At least one field blank will be returned to the laboratory with each group of samples. A field blank is treated exactly as a sample except that no air is drawn through the cartridge.

- 11.10 Samples are stored at $\sim 20^{\circ}\text{C}$ in an ice chest until receipt at the analytical laboratory, at which time they are stored refrigerated at 4°C .

12. Sample Preparation and Analysis

12.1 Sample Preparation

- 12.1.1 All samples should be extracted within 1 week after collection.
- 12.1.2 PUF cartridges are removed from the sealed container using gloved hands, the aluminum foil wrapping is removed, and the cartridges are placed into a 500-mL Soxhlet extraction. The cartridges are extracted for 14-24 hours at ~ 4 cycles/hour with 5% diethyl ether in hexane. Extracted cartridges can be dried and reused following the handling procedures in Section 10. The quartz filter can be placed in the extractor with the PUF cartridges. However, if separate analysis is desired then one can proceed with 12.1.3.
- 12.1.3 If separate analysis is desired, quartz filters are placed in a 250-mL Soxhlet extractor and extracted for 14-24 hours with 5% diethyl ether in hexane.
- 12.1.4 The extracts are concentrated to 10 mL final volume using 500-mL Kuderna-Danish concentrators as described in EPA Method 608 (5), using a hot water bath. The concentrated extracts are stored refrigerated in sealed 4-dram vials having teflon-lined screw-caps until analyzed or subjected to cleanup.

12.2 Sample Cleanup

- 12.2.1 If only organochlorine pesticides and PCBs are sought, an alumina cleanup procedure reported in the literature is appropriate (1). Prior to cleanup the sample

T04-10

extract is carefully reduced to 1 mL using a gentle stream of clean nitrogen.

12.2.2 A glass chromatographic column (2 mm ID x 15 cm long) is packed with alumina, activity grade IV and rinsed with ~20 mL of n-hexane. The concentrated sample extract (from 12.2.1) is placed on the column and eluted with 10 mL of n-hexane at a rate of 0.5 mL/minute. The eluate volume is adjusted to exactly 10 mL and analyzed as described in 12.3.

12.2.3 If other pesticides are sought, alternate cleanup procedures (e.g. Florisil) may be required. Method 608 (5) identifies appropriate cleanup procedures.

12.3 Sample Analysis

12.3.1 Sample analysis is performed using GC/ECD as described in EPA Method 608 (5). The user must consult this method for detailed analytical procedures.

12.3.2 GC retention times and conditions are identified in Table 1 for the compounds of interest.

13. GC Calibration

Appropriate calibration procedures are identified in EPA Method 608 (5).

14. Calculations

14.1 The total sample volume (V_m) is calculated from the periodic flow readings (Magnehelic) taken in Section 11.6 using the following equation.

$$V_m = \frac{Q_1 + Q_2 \dots Q_N}{N} \times \frac{T}{1000}$$

where

V_m = Total sample volume (m^3).

$Q_1, Q_2 \dots Q_N$ = Flow rates determined at the beginning, end, and intermediate points during sampling (L/minute).

N = Number of data points averaged.

T = Elapsed sampling time (minutes).

- 14.2 The volume of air sampled can be converted to standard conditions (760 mm Hg pressure and 25°C) using the following equation:

$$V_s = V_m \times \frac{P_A}{760} \times \frac{298}{273+t_A}$$

where

V_s = Total sample volume at 25°C and 760 mm Hg pressure (m^3)

V_m = Total sample flow under ambient conditions (m^3)

P_A = Ambient pressure (mm Hg)

t_A = Ambient temperature (°C)

- 14.3 The concentration of compound in the sample is calculated using the following equation:

$$C_A = \frac{A \times V_E}{V_i \times V_s}$$

where

C_A = Concentration of analyte in the sample, $\mu g/m^3$

A = Calculated amount of material injected onto the chromatograph based on calibration curve for injected standards (nanograms)

V_i = Volume of extract injected (μL).

V_E = Final volume of extract (mL).

V_S = Total volume of air samples corrected to standard conditions (m^3).

14. Performance Criteria and Quality Assurance

This section summarizes the quality assurance (QA) measures and provides guidance concerning performance criteria which should be achieved within each laboratory.

14.1 Standard Operating Procedures (SOPs)

14.1.1 Users should generate SOPs describing the following activities as accomplished in their laboratory:

- 1) assembly, calibration and operation of the sampling system, 2) preparation, purification, storage and handling of sampling cartridges, 3) assembly, calibration and operation of the GC/ECD system, and 4) all aspects of data recording and processing.

14.1.2 SOPs should provide specific stepwise instructions and should be readily available to, and understood by, the laboratory personnel conducting the work.

14.2 Process, Field, and Solvent Blanks

14.2.1 One PUF cartridge and filter from each batch of approximately twenty should be analyzed, without shipment to the field, for the compounds of interest to serve as a process blank.

14.2.2 During each sampling episode at least one PUF cartridge and filter should be shipped to the field and returned, without drawing air through the sampler, to serve as a field blank.

14.2.3 During the analysis of each batch of samples at least one solvent process blank (all steps conducted but no PUF cartridge or filter included) should be

carried through the procedure and analyzed.

- 14.2.4 Blank levels should not exceed ~10 ng/sample for single components or ~100 ng/sample for multiple component mixtures (e.g. PCBs).

14.3 Collection Efficiency and Spike Recovery

- 14.3.1 Before using the method for sample analysis each laboratory must determine their collection efficiency for the components of interest.
- 14.3.2 The glass fiber filter in the sampler is replaced with a hexane-extracted wool felt filter (weight 14.9 mg/cm^2 , 0.6 mm thick). The filter is spiked with microgram amounts of the compounds of interest by dropwise addition of hexane solutions of the compounds. The solvent is allowed to evaporate and filter is placed into the sampling system for immediate use.
- 14.3.3 The sampling system, including a clean PUF cartridge, is activated and set at the desired sampling flow rate. The sample flow is monitored for 24 hours.
- 14.3.4 The filter and PUF cartridge are then removed and analyzed as described in Section 12.
- 14.3.5 A second sample, unspiked is collected over the same time period to account for any background levels of components in the ambient air matrix.
- 14.3.6 A third PUF cartridge is spiked with the same amounts of the compounds used in 14.3.2 and extracted to determine analytical recovery.
- 14.3.7 In general analytical recoveries and collection efficiencies of 75% are considered to be acceptable method performance.

- 14.3.8 Replicate (at least triplicate) determinations of collection efficiency should be made. Relative standard deviations for these replicate determinations of $\pm 15\%$ or less is considered acceptable performance.
- 14.3.9 Blind spiked samples should be included with sample sets periodically, as a check on analytical performance.

14.4 Method Precision and Accuracy

Typical method recovery data are shown in Table 1. Recoveries for the various chlorobiphenyls illustrate the fact that all components of an Arochlor mixture will not be retained to the same extent. Recoveries for tetrachlorobiphenyls and above are generally greater than 85% but di- and trichloro homologs may not be recovered quantitatively.

REFERENCES

1. Lewis, R. G., Brown, A. R., and Jackson, M. D., "Evaluation of Polyurethane Foam for Sampling of Pesticides, Polychlorinated Biphenyls, and Polychlorinated Naphthalenes in Ambient Air", Anal. Chem. 49, 1668-1672, 1977.
2. Lewis, R. G. and Jackson, M. D., "Modification and Evaluation of a High-Volume Air Sampler for Pesticides and Semivolatile Industrial Organic Chemicals", Anal. Chem. 54, 592-594, 1982.
3. Lewis, R. G., Jackson, M. D., and MacLeod, K. E., "Protocol for Assessment of Human Exposure to Airborne Pesticides", EPA-600/2-80-180, U.S. Environmental Protection Agency, Research Triangle Park, NC, 1980.
4. Riggin, R. M., "Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air", EPA-600/4-83-027., U. S. Environmental Protection Agency, Research Triangle Park, NC, 1983.
5. Longbottom, J. E. and Lichtenberg, J. J., "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", EPA-600/4-82-057, U. S. Environmental Protection Agency, Cincinnati, OH, 1982.
6. Bjorkland, J., Compton, B., and Zweig, G., "Development of Methods for Collection and Analysis of Airborne Pesticides." Report for Contract No. CPA 70-15, National Air Pollution Control Association, Durham, NC, 1970.
7. Annual Book of ASTM Standards, Part 11.03, "Atmospheric Analysis", American Society for Testing and Materials, Philadelphia, PA, 1983.
8. Reference Method for the Determination of Suspended Particulates in the Atmosphere (High Volume Method). Federal Register, Sept. 14, 1972 or 40CFR50 Appendix B.

TABLE 1. SELECTED COMPONENTS DETERMINED USING HI-VOL/PUF SAMPLING PROCEDURE

Compound	GC Retention Time, Minutes(a)	24-Hour Sampling Efficiency(b)	
		Air Concentration ng/m ³	% Recovery
Aldrin	2.4	0.3-3.0	28
4,4'-DDE	5.1	0.6-6.0	89
4,4'-DDT	9.4	1.8-18	83
Chlordane	(c)	15-150	73
Chlorobiphenyls			
4,4' Di-	--	2.0-20	62
2,4,5 Tri-	---	0.2-2.0	36
2,4',5 Tri-	--	0.2-2.0	86
2,2',5,5' Tetra-	--	0.2-2.0	94
2,2',4,5,5' Penta-	--	0.2-2.0	92
2,2',4,4',5,5' Hexa	--	0.2-2.0	86

(a) Data from U.S. EPA Method 608. Conditions are as follows:

Stationary Phase - 1.5% SP2250/1.95% SP-2401 on
Supelcoport (100/120 mesh) packed in 1.8 mm long x
4 mm ID glass column.

Carrier - 5/95 methane/Argon at 60 mL/Minute

Column Temperature - 160°C except for PCBs which are
determined at 200°C.

(b) From Reference 2.

(c) Multiple component formulation. See U.S. EPA Method 608.

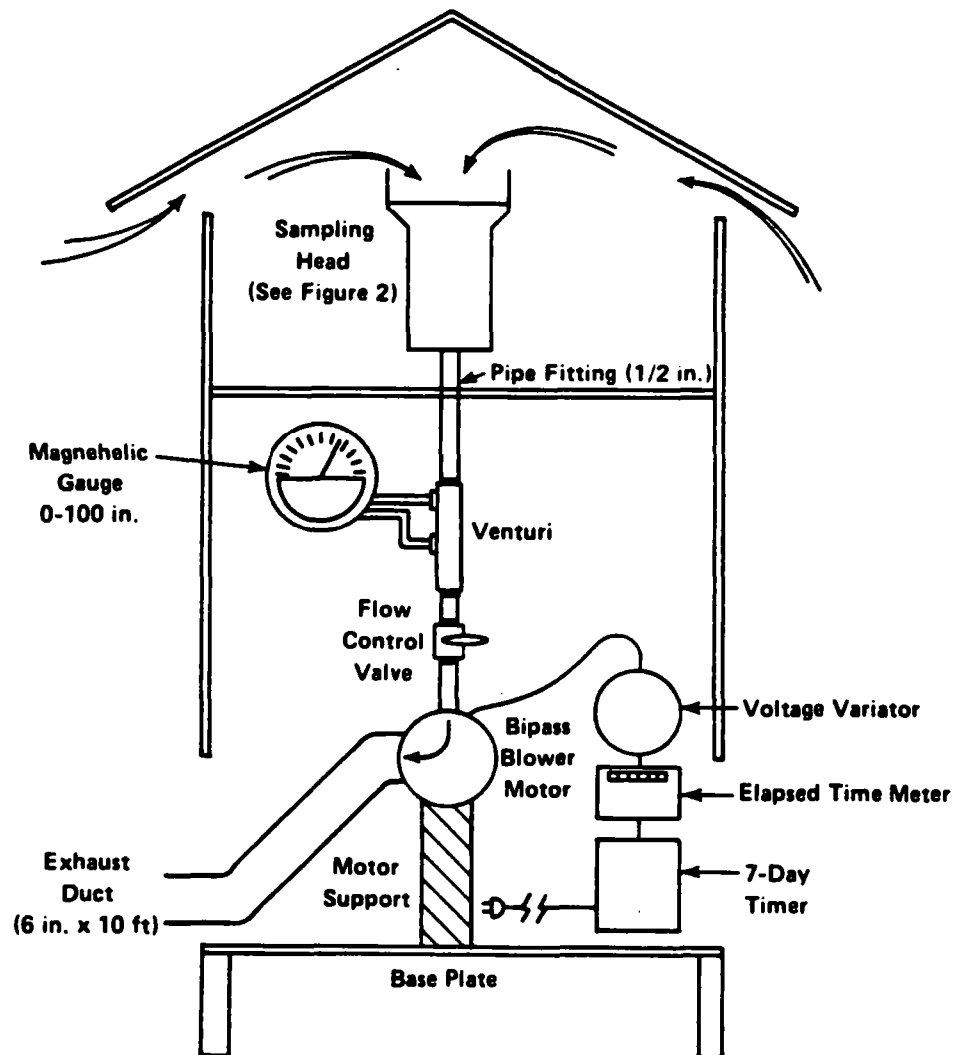


FIGURE 1. HIGH VOLUME AIR SAMPLER. AVAILABLE FROM GENERAL METAL WORKS (MODEL PS-1)

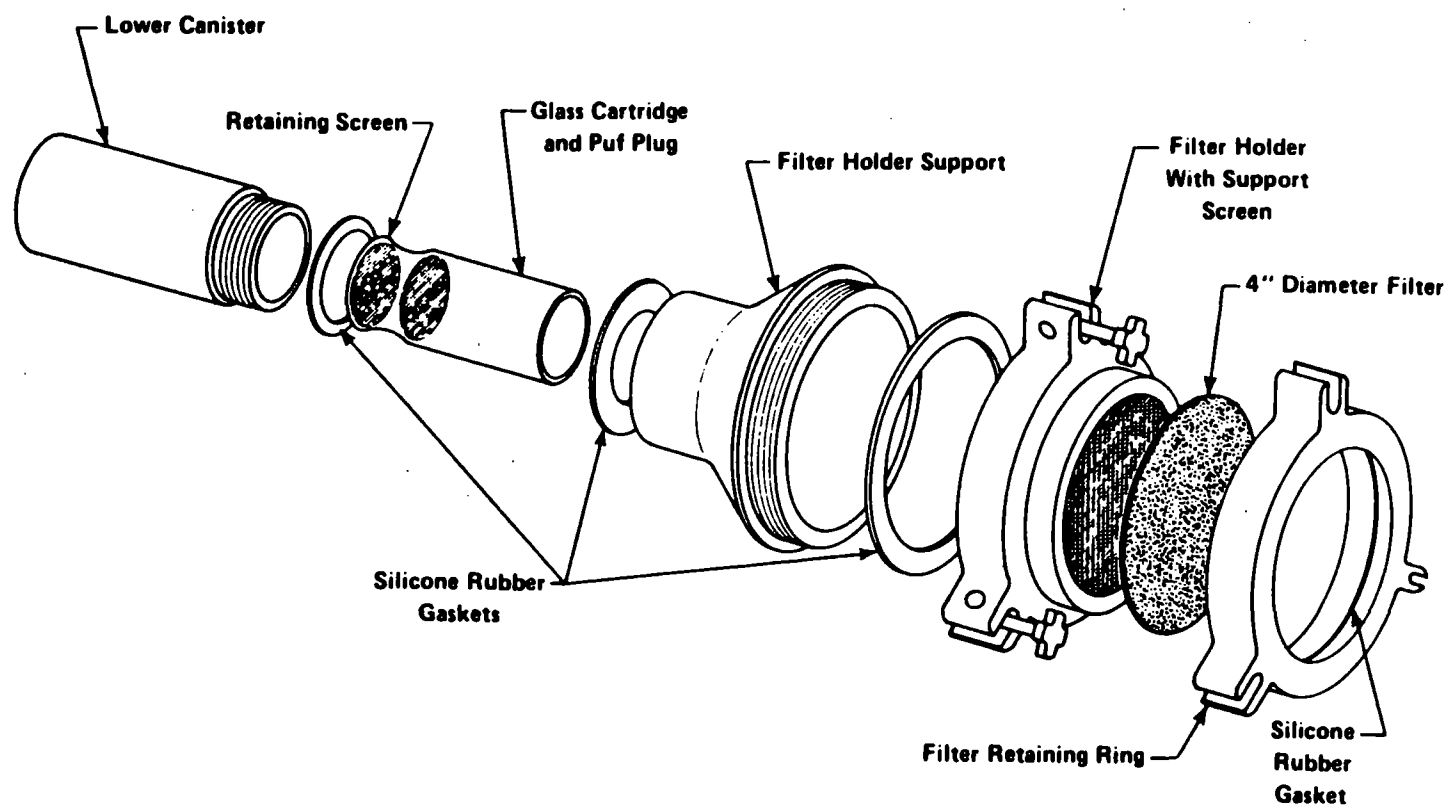


FIGURE 2. SAMPLING HEAD

Performed by _____ Calibration Orifice S/N _____ Ambient Temperature _____ °C
Date/Time _____ Manometer S/N _____ Bar.Press. _____ mm Hg

[illegible]

(a) From Calibration Tables for Calibration Orifice or Venturi Tube

(b) From Calibration Tables for Venturi Tube in each Hi-Vol unit.

Date check by _____ Date _____

FIGURE 3. TYPICAL CALIBRATION SHEET FOR HIGH VOLUME SAMPLER

T04-19

Site _____ Date _____ Performed by _____

[illegible]

(a) Record any evidence of tampering with sampler and/or abnormalities in sampler operation, PUF cartridge condition or handling, etc.

Data Checked By _____ Date _____

FIGURE 4. TYPICAL SAMPLING DATA FORM FOR HIGH VOLUME PESTICIDE/PCB SAMPLER

T04-20

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

NUMBER: FO-050

DATE: Jan. 2, 1985

PAGE: 1 of 7

Revision No.: 2

TITLE: Calibration of the GMW Model PS-1 Air Sampler

1. Purpose:

To establish the response of the magnehelic gauge/venturi system used in the GMW Model PS-1 air sampler against known flowrates as measured by a GMW Model 40 orifice calibration unit.

2. Applicability:

This procedure is applicable to the field calibration of Model PS-1 samplers over the flowrate range of 6.00 to 17.00 theoretical cubic feet per minute (tcfm). Each sampler is calibrated initially and ever six months thereafter, upon replacement of a venturi or magnehelic gauge, or when a one point flowrate audit near 8 tcfm exceeds +10% difference.

3. Responsibilities:

Personnel performing or evaluating field calibrations will be knowledgeable of this SOP.

4. References:

- 4.1 Operating Instructions, Model PS-1 (published by General Metal Works, Inc.).
- 4.2 Investigation of Flow Rate Calibration Procedures Associated with the High Volume Method for Determination of Suspended Particulates, EPA-600/4-78-047, August 1978.
- 4.3 40 CFR, Part 50, Appendix B.

5. Equipment:

- 5.1 GMW Model 40 orifice calibration unit with water manometer, manometer accurate to within ± 0.05 inch.
- 5.2 GMW Model PS-1 sampler.
- 5.3 Thermometer, accurate to within ± 0.5°C.
- 5.4 Barometer, accurate to within ± 1 mmHg.

6. Procedure:

NOTE: Record calibration data on the GMW Model PS-1 Calibration Form, see Attachment A.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

DATE: Jan. 2, 1985

PAGE: 2 of 7

Revision No.: 2

TITLE: Calibration of the GMW Model PS-1 Air Sampler

6.1 Pre-calibration:

1. Obtain the atmospheric pressure (in mmHg) at the samplers location from an established meteorological station.
2. Open the PS-1 sampler hood and secure it to the back latch.
3. Attach the thermometer and manometer support braces to the top edge of the shelter.
4. Attach the thermometer and manometer to their respective support braces.
5. Open both ports on the manometer by turning the L-connectors 3/4 revolution counter-clockwise, then connect a 2' section of 3/16" I.D. latex hose to one of the ports.
6. Check the manometer liquid for free movement against pressure and adjust the manometer scale to zero.

NOTE: Refer to figures 1 and 2 for identification of the sampler components.

7. Remove the polyethylene cover from the aluminum sampling module, then disconnect the module from the sampler's pneumatic line.
8. Check the meter zero on the sampler's magnehelic gauge and adjust to zero if necessary.
9. While holding the sampling module in an up-right position, unscrew and remove the lower canister from the filter holder support.
10. Hand tighten the module's filter holder support/filter holder connection.
11. Check for the presence of a gasket in the bottom of the lower canister, and also in the base of the filter holder support. If either gasket is missing, install another before proceeding.
12. Place an empty glass cartridge (2.5" O.D. x 5.25" length) in the lower canister, then reconnect the canister to the filter holder support.

Caution: Do not attempt to over-tighten the canister/filter holder support connection. Hand tighten only. Too much force will break the glass cartridge.

13. Reconnect the sampling module to the sampler's pneumatic line by applying torque only to the module's lower canister. Hand tighten only.
14. Remove the filter retaining ring from the filter holder.
15. Place the GMW Model 40 orifice calibration unit (OCU) on the filter holder and secure it to the holder by tightening the three swing bolts.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

NUMBER: FO-050

DATE: Jan. 2, 1985

PAGE: 3 of 7

Revision No.: 2

TITLE: Calibration of the GMW Model PS-1 Air Sampler

16. Fully open the sampler's ball-valve.
17. Engage the sampler's power switch, located on the Paragon timer.
18. With a screwdriver, adjust the sampler's voltage control screw (located next to the elapsed time meter) to obtain a magnehelic gauge reading of 100.
19. Plug the OCU's top opening with a No. 0 rubber stopper, and the OCU's side arm port with a finger. The sampler's magnehelic gauge should read exactly zero.

NOTE: If the magnehelic reading is above zero, then an air leak is present. Eliminate any leak before continuing. If the magnehelic display is below zero, then contact the Springfield headquarters before proceeding. Record all actions on the calibration form.

20. Upon completion of the leak check, unplug the OCU, then disengage the sampler's power switch.
21. Connect the free end of the 3/16" I.D. latex hose on the manometer to the OCU side arm port.
22. Re-engage the sampler's power switch and allow the system to warm up for 10 minutes.

6.2 Calibration:

1. Slightly close the sampler's ball valve until the magnehelic gauge is at 70. Record the magnehelic display, water manometer displacement to within ± 0.05 inch, and thermometer reading to within $\pm 1^\circ\text{C}$.
2. Repeat step 6.2.1 for magnehelic gauge readings at 60, 50, 40, 30, and 20 units, respectively.

Q.C. Check: If any of the following quality control limits are exceeded, then the calibration is void:

- (a) The ambient temperature must be at least 50°C , but not greater than 38°C ,
- (b) The difference between the maximum and minimum temperature measured during the calibration cannot exceed 5°C , and
- (c) The difference between the initial and final water manometer displacements (magnehelic gauge readings at 70) cannot exceed ± 0.15 inch.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

NUMBER: FO-050

DATE: Jan. 2, 1985

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Revision No.: 2

TITLE: Calibration of the GMW Model PS-1 Air Sampler

6.3 Post-calibration:

1. Disengage the sampler's power switch.
2. Disconnect the latex hose from the manometer and OCU, then close the manometer ports.
3. Remove the OCU manometer, thermometer, and manometer and thermometer support braces.
4. Reattach the filter retaining ring to the filter holder.
5. Disconnect the aluminum sampling module from the sampler's pneumatic line.
6. While holding the sampling module in an up-right position, unscrew and remove the lower canister from the filter holder support.
7. Remove the empty glass cartridge from the lower canister, then reconnect the canister to the filter holder support.
8. Reconnect the sampling module to the sampler's pneumatic line.
9. Cover the sampling module with a clean polyethylene bag.
10. Close and secure the shelter's hood.
11. Complete the calibration form.

JB:jd/1435D/1,4/sp

GMW MODEL PS-1 CALIBRATION FORM

Name: _____ Date: _____

Site Address: _____

PS-1 Shelter No.: _____ Station Pressure: _____

GMW Model 40' OCU No.: _____

Magnehelic
Gauge ReadingManometer
Reading (in. H₂O)OCU Flow-
Rate (tcfm)Temp. (°C)

Comments: _____

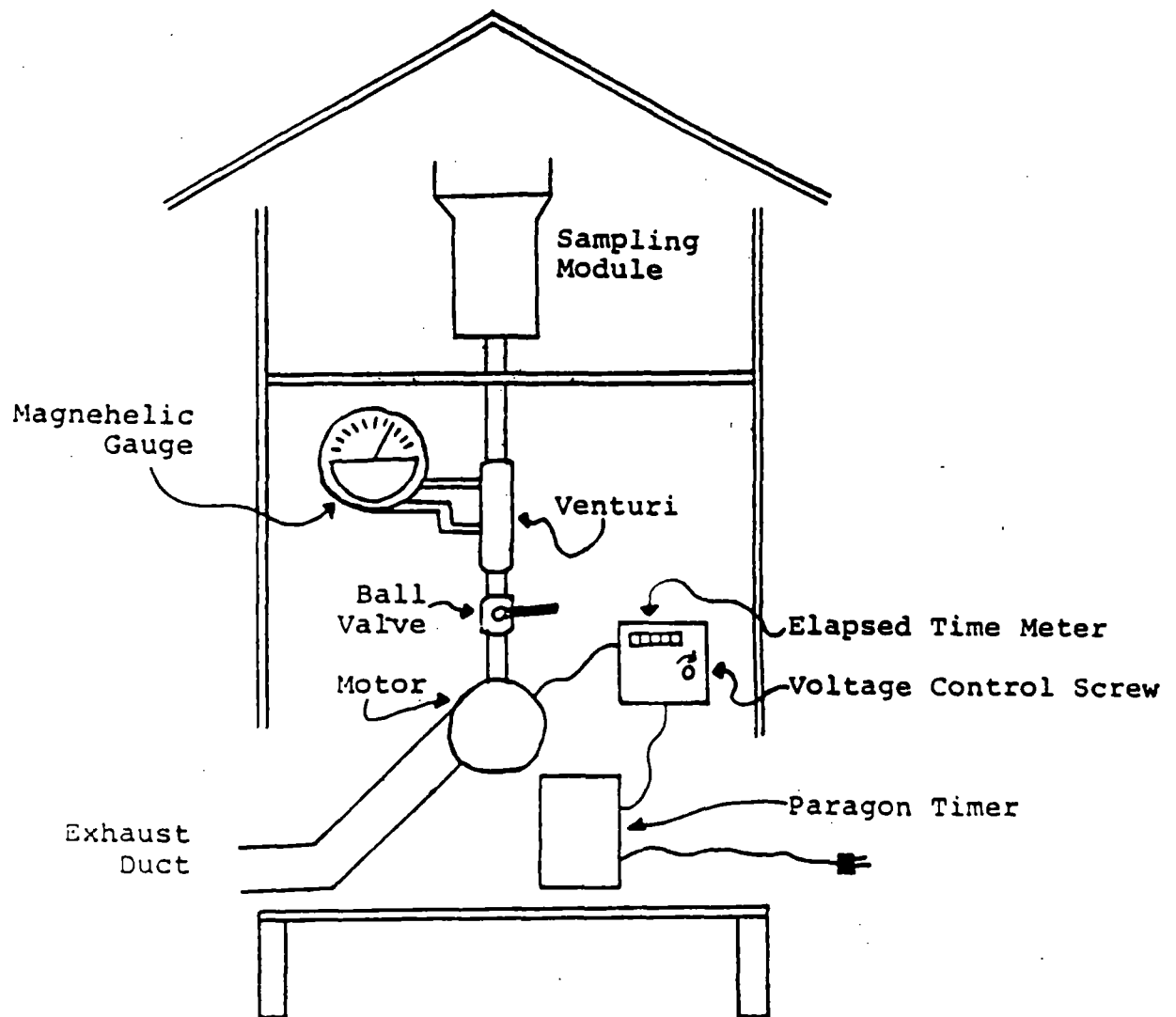


Figure 1 GMW Model PS-1 Sampler

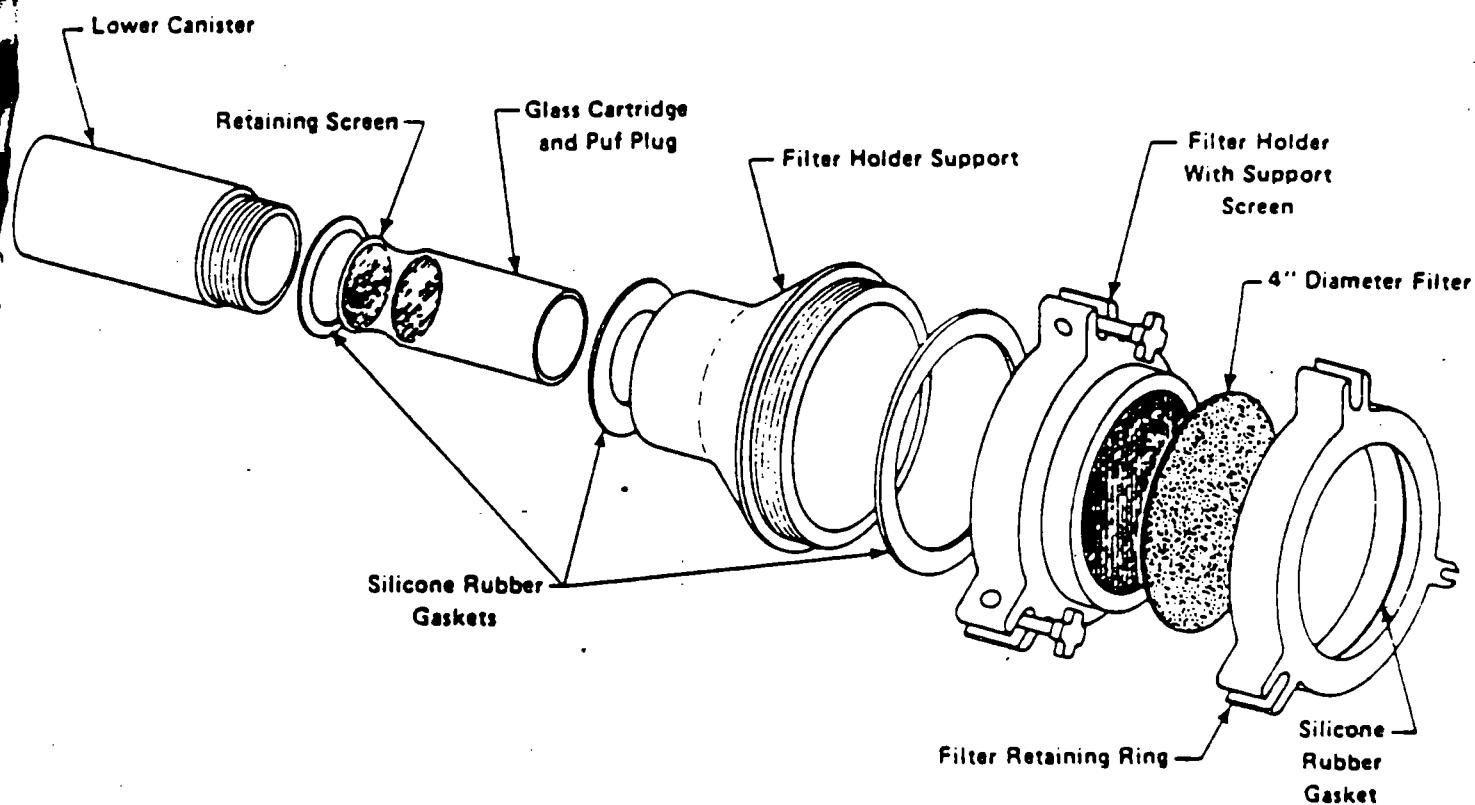


Figure 2 Sampling Module

AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES

DATE: Jan. 2, 1985

PAGE: 1 of 10

Revision No.: 2

TITLE: Operation of the GMW Model PS-1 Air Sampler

1. Purpose:

To provide for the operation of the GMW Model PS-1 air sampler in order to collect samples representative of ambient air quality.

2. Applicability:

This procedure is applicable to the on-site operation of the PS-1 sampler.

3. Responsibilities:

Personnel involved in operating and maintaining the PS-1 sampler will be knowledgeable of this SOP.

4. References:

4.1 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA-600/4-84-041, April 1984.

4.2 Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples, EPA-600/8-80-038, June 1980.

5. Equipment:

5.1 GMW Model PS-1 air sampler.

6. Procedures:

6.1 Pre-sampling activities:

NOTE: Refer to figures 1 and 2 for identification of the sampler components. Prior to initiation of the following steps, clean the module as outlined in Step No. 20 of Section 6.2.

1. Open the PS-1 sampler hood and secure it to the back latch. Also open the sampler door.
2. Check the meter zero on the sampler's manometric gauge and adjust to zero if necessary.
3. Remove the polyethylene cover from the aluminum sampling module, then disconnect the module from the sampler's pneumatic line.
4. Close and secure the sampler's hood and door.

TITLE: Operation of the GMW Model PS-1 Air Sampler

5. Take the sampling module to a favorable work area, preferably an indoor location. An ice chest containing two clean sample cartridges (loaded with PUF) in their protective containers, two glass fiber filters in aluminum pouches, and a container with extra n-hexane rinsed aluminum foil should be located in the work area. The ice chest should not be cooled with ice packs at this time.
6. Unscrew and remove the sampling module's lower canister from the filter holder support.
7. Check the module's filter holder/filter holder support connection and hand tighten if necessary.
8. Check the gasket in the bottom of the lower canister, and in the base of the filter holder. Replace the gaskets if necessary.

CAUTION: Cover each hand with an unused, disposable polyethylene glove. If the gloves are not available, contact the Springfield headquarters before proceeding.

9. Open a protective container and remove the sample cartridge.
10. Unwrap the hexane rinsed aluminum foil from around the cartridge. Avoid tearing the foil as it will be needed at the end of the sampling period.
11. Slide the cartridge into the sampling module's lower canister. The end with the metal screen must be inserted first. Also note the number inscribed on the cartridge.
12. Neatly fold the aluminum foil wrapper and return it to the cartridge's protective container, then reseal the container.
13. Reconnect the sampling module's lower canister to the filter holder support. Do not attempt to over-tighten the connection since too much force will break the glass sample cartridge.
14. Record the sample cartridge number on the PS-1 Sample Information Form in the area marked "Sample Cartridge Number", see Attachment A.
15. The extra sample cartridge is designated as a trip blank cartridge. Remove the trip blank cartridge from its protective container, then unwrap the hexane rinsed aluminum foil from around the cartridge. Avoid tearing the foil as it will be needed at the end of the sampling period.
16. Note the number inscribed on the trip blank cartridge.
17. Wave the trip blank cartridge back and forth a few times, then return it to its container. Neatly fold the cartridge's aluminum foil wrapper and insert it between the cartridge and the inside of the protective container. Reseal the container.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

DATE: Jan. 2, 1985

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Revision No.: 2

TITLE: Operation of the GMW Model PS-1 Air Sampler

18. Record the trip blank cartridge number on the PS-1 Sample Information Form in the area marked "Blank Cartridge Number", see Attachment A.
19. Open an aluminum pouch containing one of the clean glass fiber filters. Avoid tearing the pouch as it will be reused.
20. Wave the glass fiber filter back and forth a few times, then reinsert it back into its pouch. Reseal the pouch and place it in the ice chest. This filter is now designated as the trip blank filter.
21. Take the sampling module and the remaining unopened pouch containing the sample filter to the PS-1 sampler. You will also need a single-holed resistance plate and a silicone gasket.
22. Open the PS-1 sampler hood and secure it to the back latch. Also open the sampler's door.
23. Connect the sampling module to the samplers pneumatic line by applying torque only to the module's lower canister. Hand tighten only.
24. Remove the filter retaining ring from the module's filter holder. Place the silicone gasket on the filter holder, then position the single-holed resistance plate on top of the gasket. Place the filter retaining ring over the resistance plate and secure it to the filter holder by tightening the three swing bolts.
25. Record the elapsed time meter reading as the initial reading, then engage the sampler's power switch.
26. Plug the opening on the resistance plate with a finger. The sampler's magnehelic gauge should read exactly zero.

NOTE: If the magnehelic reading is above zero, then an air leak is present. Eliminate the leak before continuing. If the magnehelic display is below zero, then contact the Springfield headquarters before proceeding. Record all actions on the PS-1 Sample Information Form.

27. Upon completion of the leak check, disengage the sampler's power switch.
28. Remove the filter retaining ring, resistance plate, and gasket.
29. Open the aluminum pouch containing the clean glass fiber filter and remove the filter. The pouch may be discarded.
30. Center the filter, rougher side up, on the filter holder. Position the filter retaining ring over the filter and secure it to the holder by tightening the three swing bolts. Do not overtighten as the filter tends to adhere to the retaining ring.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

DATE: Jan. 2, 1985

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Revision No.: 2

TITLE: Operation of the GMW Model PS-1 Air Sampler

31. Discard the used polyethylene gloves.
32. Engage the sampler's power switch and adjust the ball valve until the magnehelic gauge is near a value of 40.
33. Allow the sampler's motor to warm up for five minutes, then adjust the ball valve until the magnehelic gauge is at the value of 40 (or some other value as determined by the Springfield headquarters). A gauge value at 40 corresponds to a flowrate near 8 tcfm (theoretical cubic feet per minute).
34. Disengage the power switch and set the Paragon timer wheel to the current day and time. Also position the timer's trip pins to activate and deactivate sampling at the designated times.

NOTE: Under no circumstances may the sample cartridge be installed in the sampler for longer than 12 hours prior to the start of sampling.

35. Close and secure the sampler's hood and door.
36. Record all relevant data on the PS-1 Sample Information Form. Retain the form in a secure location.

6.2 Post-sampling activities:

NOTE: The exposed filter and cartridge must be retrieved within 6 hours after the sampling period ends.

1. Open the sampler's hood and secure it to the back latch. Also open the sampler's door.
2. Engage the sampler's power switch and allow the motor to warm up for 5 minutes, then record the magnehelic gauge display as the final reading.
3. Disengage the sampler's power switch and record the final elapsed time meter reading.
4. Disconnect the aluminum sampling module from the sampler's pneumatic line.
5. Close and secure the sampler's hood and door.
6. Take the sampling module to a favorable work area, preferably an indoor location. A cooled ice chest containing the trip blank cartridge and filter, the sample cartridge's protective container, and a container with extra hexane rinsed aluminum foil should be located in the work area.

CAUTION: Cover each hand with an unused, disposable polyethylene glove. If the gloves are not available, contact the Springfield headquarters before proceeding.

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

NUMBER: FO-051

DATE: Jan. 2, 1995

PAGE: 5 of 10

Revision No.: 2

TITLE: Operation of the GMW Model PS-1 Air Sampler

7. Unscrew and remove the sampling module's lower canister from the filter holder support.
8. Open the sample cartridge's protective container, remove the aluminum foil wrapper and unfold it.
9. Slide the cartridge out of the sampling module's lower canister.
10. Rewrap the exposed cartridge with the foil and insert it into the protective container.
11. Open the container with the spare aluminum foil, remove a piece and unfold it.
12. Carefully remove the exposed glass fiber filter from the sampling module.
13. Fold the filter in half, with the exposed surface on the inside of the fold, then fold the filter in half again.
14. Wrap the folded filter with the spare aluminum foil, then place the filter in the sample cartridge container. Reseal the cartridge container.
15. Remove the trip blank cartridge from its container and wave it back and forth a few times. Rewrap the cartridge in its original foil cover and return the cartridge to its container.
16. Remove the trip blank filter from its pouch and wave it back and forth a few times. Discard the pouch.
17. Fold the filter in half twice, then wrap it with a piece of spare aluminum foil. Place the filter in the trip blank cartridge container. Reseal the trip blank and spare aluminum foil containers.
18. Discard the used polyethylene gloves.
19. Fill out sample labels (see Attachment B) for the sample and trip blank. Stick the labels on the appropriate protective container, then return the containers to the cooled ice chest.
20. Obtain a clean, unused cloth rag and dampen it with GC grade n-hexane. Thoroughly scrub down the sampling module with the hexane moistened cloth. Then clean the sampling shelter's upper platen and inside walls with the same rag. Discard the used cloth.
21. Re-assemble the sampling module. Return the module to the PS-1, open the sampler's hood, then reconnect the module to the sampler's pneumatic line.
22. Cover the sampling module with a polyethylene bag.
23. Close and secure the sampler's hood.
24. Complete the PS-1 Sample Information Form in triplicate. Retain the original with the sample and trip blank, forward one copy to the Springfield headquarters, and file the remaining copy.
25. Repack the sample and trip blank protective containers in a cooled shipping container. Mail the cooler to the designated analytical laboratory within 24 hours after the end of sampling.

JB:bjh/sp/19130/1,5

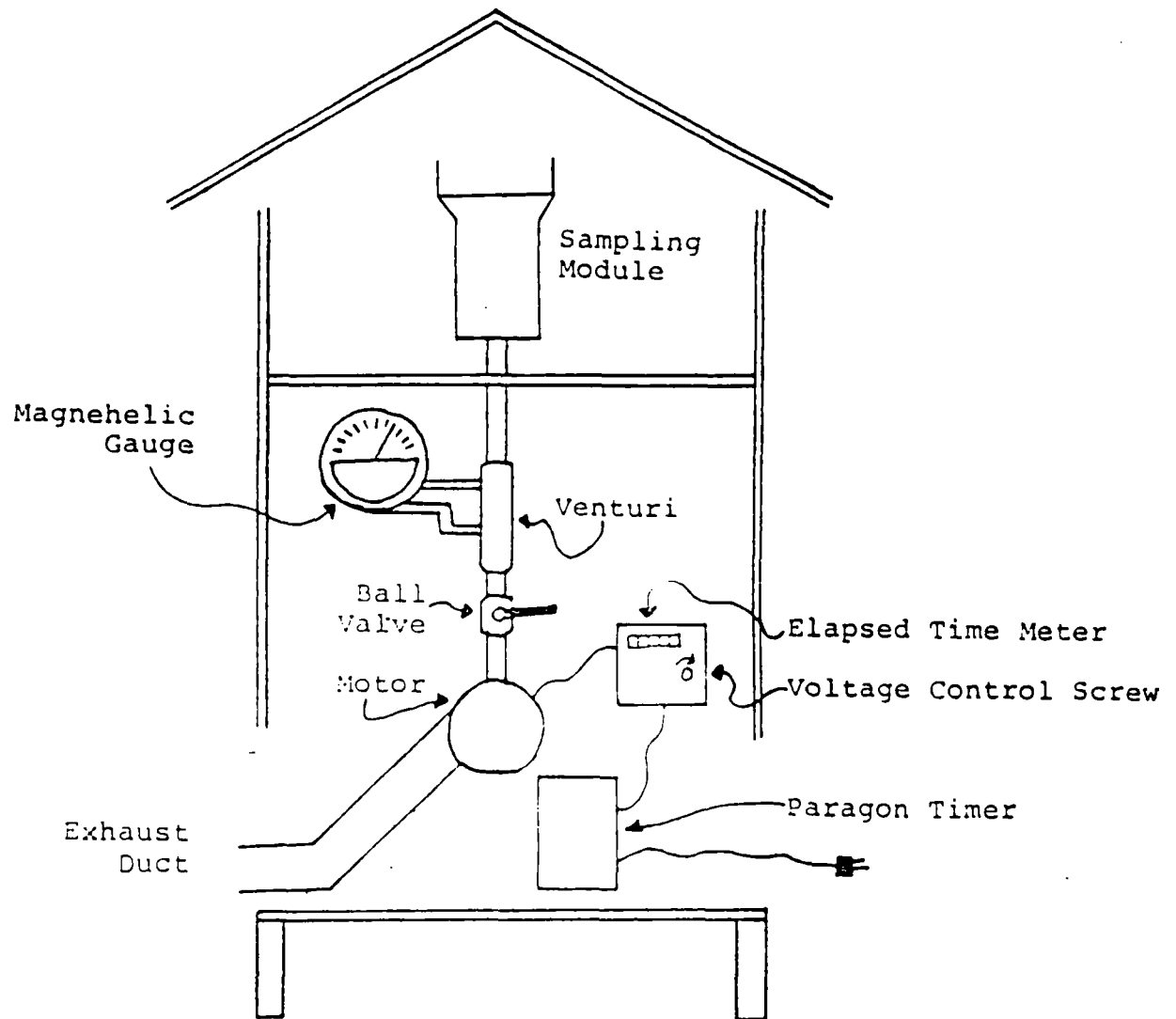


Figure 1 GMW Model PS-1 Sampler

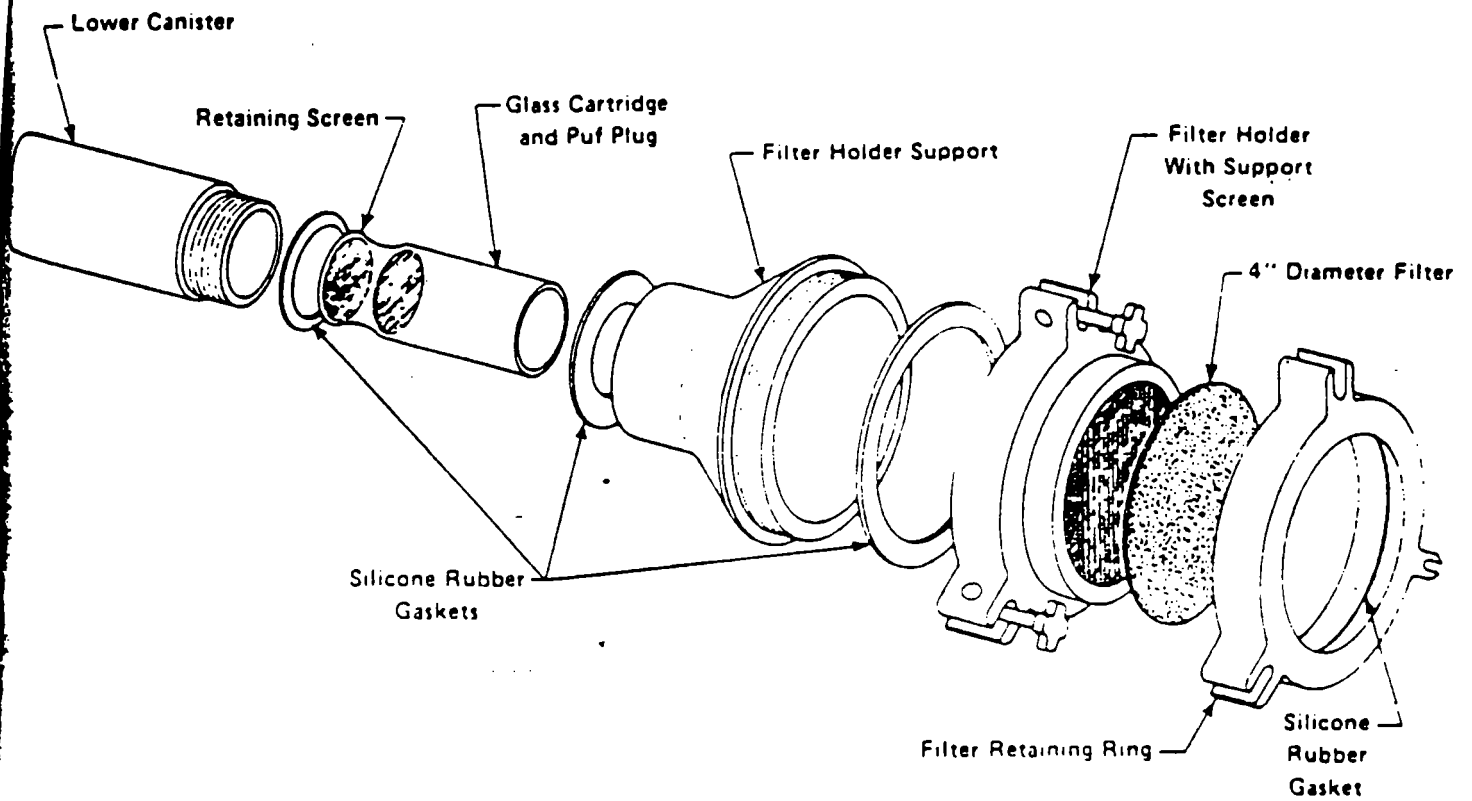


Figure 2 Sampling Module

PS-1 Sample Information Form

Sample Number: _____ Collector: _____

Sample Location: _____

Initial Elapsed Timer Reading:

--	--	--	--	--

--

Final Elapsed Timer Reading:

--	--	--	--	--

--

Total Elapsed Time: _____ min

Initial

Final

Magnehelic Gauge Reading: _____

Flowrate: _____

tcfm

tcfm

Average Flowrate During Sampling: _____ tcfm

Date and Time Cartridge Installed: _____

A.M.

P.M.

Date and Time Sampling Started: _____

A.M.

P.M.

Date and Time Sampling Stopped: _____

A.M.

P.M.

Date and Time Cartridge Removed: _____

A.M.

P.M.

PS-1 Sampler IEPA Number: _____

Sample Cartridge Number: _____ Blank Cartridge Number: _____

Comments: _____

For Laboratory Use

CHAIN OF CUSTODY RECORD

DATE	TIME	ACTION TAKEN AND SIGNATURE
------	------	----------------------------

BH:rd3142C/3-4

ATTACHMENT 3

RESPONSES TO USEPA's DECEMBER 11, 1987 COMMENTS
ON THE JUNE 26, 1987 WORK PLAN



Chevron Chemical Company

6001 Bollinger Canyon Road, San Ramon, California
Mail Address: P.O. Box 5047, San Ramon, CA 94583-0947

February 8, 1988

FEB 1

Maryland Heights
CERCLA Investigation

Mr. Robert L. Morby
Superfund Branch
EPA Region VII
726 Minnesota Avenue
Kansas City, KS 66101

Dear Mr. Morby:

Attached is Chevron Chemical's responses to EPA's December 11, 1988 comments on the June 26, 1987 revised Work Plan for the Maryland Heights, Missouri facility.

One item is not addressed on the attachment. It concerns EPA's comment about the schedule shown in Figure 10 of the Work Plan. Figure 10 was revised to include all of the decision points listed on pages 4 and 5 of EPA's May 20, 1987 letter. These decision points, which appear in various sections of the Work Plan were not shown individually in the figure. Instead they were incorporated into the figure's main headings. This approach was approved by Mr. Steven Kinser of EPA.

Chevron requests that EPA officially approve the Work Plan. Chevron has acted in good faith to conduct the site investigation at the Maryland Heights facility and has proceeded, with EPA's encouragement, with the project even though the Work Plan has not been approved by EPA. However, we feel we can not proceed with the project without EPA approval of the Work Plan.

If you have any questions concerning these matters, please contact me at (415) 842-5882.

Sincerely,


David J. Sander

DJS/
Attachment

cc: Mr. J. D. Campbell (Woodward-Clyde Consultants)
Mr. B. E. McCullough (MODNR)
Ms. Catherine M. Barrett (EPA)

bcc: Mr. D. L. Jeffries
Mr. S. K. Knox
Mr. W. D. Moriarty
Mr. F. A. Treibel
CERCLA Files

WORK PLAN

Comment

Response

Page 8, Section 3.1.1.1

Chevron's ground water monitoring plan calls for (OWC-) 1, 12A, 14, 15, 16, 17, 18, 19, 20, 24, and 25 to be sampled and analyzed on a quarterly basis. These monitoring wells have been regularly sampled in the past because they represent locations upgradient (OWC-1) and the most downgradient possible within the potentially contaminated zone. It was felt that these wells would supply the required information for delineation of the contaminant plume. Therefore, these wells were selected for quarterly monitoring. Chevron's intention in sampling OWC-7 in November 1986 was an attempt to identify the area of maximum xylene concentration for the purpose of evaluating a proposed extraction system. The results of the analyses indicated that well OWC-7, with a xylene concentration of 160 ug/l was not located within the area of maximum xylene concentration. Therefore, the monitoring of OWC-7 was discontinued.

Page 9, Section 3.1.1.1
-(Table 1)

Results from the July 1987 field investigation revealed the absence of ethylene thiourea in all 83 soil samples obtained and analyzed. Maneb was detected in eight environmental samples and two duplicates in concentrations ranging from 3 mg/kg to 22 mg/kg. Maneb was not

Comment

Page 9, Section 3.1.1.1
(Table 1)

Page 12, Section 3.2.1

Response

detected in sample intervals below 4.5 feet, therefore, Chevron does not believe Maneb and ethylene thiourea need to be added to the list of parameters analyzed in ground water.

Chevron does not believe that the sampling of existing off-site wells is necessary if the newly installed down-gradient off-site monitoring wells, OWC-24 and OWC-25, reveal no contamination or contaminant levels below their respective MCL's or other health advisory criteria. OWC-24 and OWC-25 revealed no contamination during sampling events conducted in August and September 1987.

Lindane at a level of 0.53 ug/l was reported in well OWC-25 during the December 1987 quarterly ground water sampling event. Confirmation of the existence of this contaminant in well OWC-25 will take place during future ground water monitoring events.

Many of the existing off-site wells identified during the off-site surveys conducted in 1981 and 1984 could not be field located. However, two off-site wells were and sampled in 1984 and analytical results indicated non-detectable levels of the contaminants of concern including 2,4,5-T, 2,4-D, and

Comment

Response

Page 12, Section 3.2.1 (cont.)

xylol at a detection limit of 1.0 ug/l, 4,4-DDD, 4,4-DDE, 4,4-DDT, aldrin, dieldrin, heptachlor, lindane, and endrin at a detection limit of 0.10 ug/l and methoxychlor, toxaphene, and chlordane at a detection limit of 5.0 ug/l. Arsenic at 0.3 ug/l and 0.1 ug/l was reported, but these low levels were attributed to natural background conditions.

Page 18, Section 5.3

Chevron will re-check OWC-21, OWC-22, and OWC-23 for a hydrocarbon layer during the next quarterly sampling event (March 1988). If a hydrocarbon layer is absent, the wells will not be checked again. If a hydrocarbon layer is observed, a sample of the material will be retained and analyzed.

Page 28, Section 7.4.1.3

Chevron believes that due to the lack of ground water use in the area, a 10^{-5} risk factor may be more appropriate.

Figure 9

OWC-24 and OWC-25 were sited based on historical water level information and ease of access (i.e. no obstructions such as buildings and/or parking lots). Due to the absence of Maneb contamination in soil below 4.5 feet (as reported based on the July 1987 field investigation results), concern over a Maneb plume does not appear warranted. Chevron believes the location of these

Comment

Figure 9 (cont.)

Response

newly installed wells will adequately investigate any potential arsenic migration.

HEALTH AND SAFETY PLAN

Comment

Table 1, Page 6

Response

The hazards associated with 2,4,5-T and DDT due to skin contact have been noted. Care was taken during the July 1987 field investigation to minimize these hazards by utilizing Tyvek and gloves taped at the wrists.

Page 13, Section 5.1

Since the contaminants of concern are primarily pesticides and do not possess a highly volatile nature, drilling in modified Level D with contingency to upgrade to Level C based on HNu readings and/or visible nuisance dust was implemented. Also, since the field work was conducted in July and heat stress was a real concern, modified Level D and Tyvek coveralls seemed appropriate to minimize the potential health effects related to heat stress.

Page 17, Section 6.2

Tyvek coveralls were disposed following use and not washed down. Respirators are cleaned and inspected daily and are never washed or cleaned while being worn. Hard hats were always removed

Comment

Page 17, Section 6.2 (cont.)

Figure 2

Response

prior to removing safety glasses and/or respirators.

Figure 2, as presented in the site specific Health and Safety Plan dated June 1, 1987, illustrates the estimated extent of on-site ground water contamination. Figure 4, as presented in the site specific Health and Safety Plan dated June 1, 1987, relates to proposed soil sampling locations for the July 1987 field investigation.

SAMPLING PLAN

Comment

Page 4, Section 2.1.1.3

(4)

Response

Total well depth is recorded during each sampling event as standard practice. This information, coupled with the static water level, allows the volume of standing water within the well column to be calculated.

(5)

Subsequent to the installation of downgradient monitoring wells OWC-24 and OWC-25 in July 1987, purge water was discharged directly to the ground surface. Analytical results indicate that there are non-detectable or only very low levels of the constituents of

Comment

Response

(5) (cont.)

concern and placement of this water directly on the ground surface does not represent a significant health risk or contribute to additional contamination at or near the site.

(7)

The security line is always discarded between wells and no attempt is made to decontaminate the nylon rope for subsequent re-use.

(10)

A decontamination solvent was eliminated from the decontamination process in order to minimize the potential for accidental spill and/or leakage thereby enhancing potential contaminant migration. Decontamination procedures included an Alconox and water scrub, followed by a potable water rinse and a deionized water rinse. All drilling and subsurface sampling equipment were decontaminated by steam cleaning.

(12)

Bailers are carefully lowered into the wells at all times to minimize the potential loss of volatile constituents (xylene).

Page 9, Section 2.1.2.3

A decontamination blank was not collected in July 1987. However, a decontamination blank is routinely collected during each quarterly ground water monitoring event.

Comment

Page 9, Section 2.1.2.3 (cont.)

Response

Use of the decontamination solvent was eliminated as discussed in response to comment (10).